SECTION 00 00 10
DIVISION 0 TABLE OF CONTENTS

1.01 DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 03 - Project Directory
00 01 05 - Certification/Verification Pages
00 01 10 - Table of Contents
00 01 15 - List of Drawing Sheets
00 31 00 - Available Project Information
00 40 00 - Contract Packet Forms
00 43 25 - Substitution Request Form
00 52 00 - Agreement Form
00 72 00 - General Conditions

END OF SECTION

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SECTION 00 01 03
PROJECT DIRECTORY

OWNER

LT REAL ESTATE COMPANY, INC.

2902 Corporate Place
Chanhassen, MN 55317
Telephone: 888.430.5433

ARCHITECT

LT ARCHITECTURE, INC.

2902 Corporate Place
Chanhassen, MN 55317
Telephone: 952.947.0000
Facsimile: 952.946.9794

ARCHITECT OF RECORD: MATTHEW BRINZA

e-mail: MBrinza@lt.life

PROJECT MANAGER: MARK NICKELSON

e-mail: MNickelson@lt.life

CONTRACTOR

LTF CONSTRUCTION COMPANY, INC.

2900 Corporate Place
Chanhassen, MN 55317
Telephone: 952.229.7197
Facsimile: 952.946.9794

CONTACT: WILLIAM BROWN

e-mail: WBrown2@lt.life

STRUCTURAL ENGINEER

VAA ENGINEERS

2300 Berkshire Lane North
Suite 200
Plymouth, MN 55441
Telephone: 651.414.6133

ENGINEER OF RECORD: GREG MOSIER

GMosier@vaaeng.com

MECHANICAL/ELECTRICAL ENGINEERS

EMANUELSON-PODAS, INC

7705 Bush Lake Road
Edina, MN 55429

MECHANICAL CONTACT: SAM NORDSTROM

Telephone - Direct: 952.255.6206

e-mail: SNordstrom@epinc.com

ELECTRICAL CONTACT: DANNY JOHNSON

Telephone - Direct: 952.540.4017

e-mail: Djohnson@epinc.com

LANDSCAPE

MCNEIL ENGINEERING

8610 South Sandy Parkway

Suite 200

Sandy, Utah 84070

Telephone: 801.255.7700

CONTACT: SCOTT SCHOONOVER

e-mail: scotts@mcneileng.com

CIVIL ENGINEER

MCNEIL ENGINEERING

8610 South Sandy Parkway

Suite 200

Sandy, Utah 84070

Telephone: 801.984.2848

CONTACT: JAKE FELSHOW

e-mail: jake@mcneileng.com

FOOD EQUIPMENT CONSULTANT

BOELTER PREMIER

7120 Northland Terrace

Minneapolis, MN 55428

Telephone: 763.544.8800

CONTACT: TODD OLSON

e-mail: tolson@premiereq.com

AQUATICS ENGINEER

REENGINEERED, INC

PO Box 480

Monticello, MN 55362

Telephone: 952.401.9794

CONTACT: SYRUS JALALI

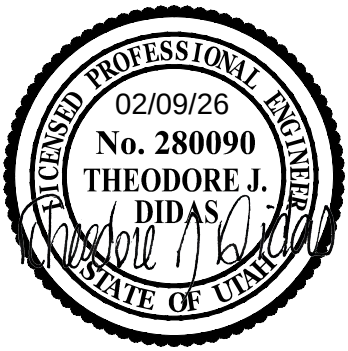
e-mail: syrus@reengineeredinc.com

END OF SECTION

SECTION 00 01 05.02
CERTIFICATION PAGE - CIVIL

AFFIX STAMP BELOW

CIVIL ENGINEER



Theodore J. Didas **02/09/26**

DATE

LICENSE NO. 280090

END OF DOCUMENT

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SECTION 00 01 05.03
CERTIFICATION PAGE - STRUCTURAL

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STRUCTURAL ENGINEER



02/09/2026
DATE

LICENSE NO. 9832536

SPECIFICATION SECTIONS:
03 20 00, 03 30 00, 04 20 00, 05 12 00,
05 21 00, 05 31 00 AND 05 40 00

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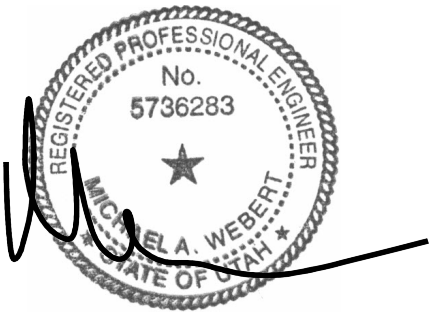
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MECHANICAL ENGINEER

MICHAEL A. WEBERT 02/09/2026
DATE

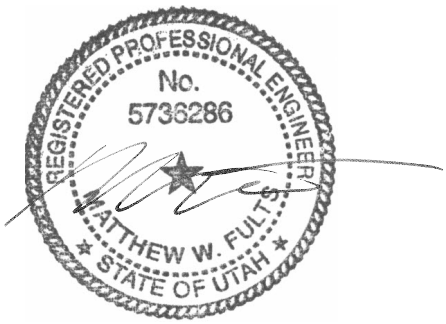
LICENSE NO. 5736283



ELECTRICAL ENGINEER

MATTHEW W. FULTS 02/09/2026
DATE

LICENSE NO. 5736286



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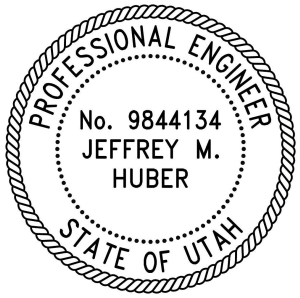
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AQUATICS ENGINEER

02/09/2026
DATE

LICENSE NO. 9844134



END OF DOCUMENT

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SECTION 00 01 10
TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 03 - Project Directory

00 01 05 - Certification/Verification Pages

00 01 10 - Table of Contents

00 31 00 - Available Project Information

00 40 00 - Contract Packet Forms

00 43 25 - Substitution Request Form

00 52 00 - Agreement Form

00 72 00 - General Conditions

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00 - Summary of Work

01 31 00 - Project Management and Coordination

01 31 01 - Project BIM Coordination

01 31 02 - BIM Coordination Sign-off

01 33 00 - Submittal Procedures

01 33 01 - Sample Submittal Log

01 40 00 - Quality Requirements

01 43 39 - Mockups

01 45 33 - Code Required Special Inspections and Procedures

01 45 34 - Special Inspections Acknowledgement Form

01 60 00 - Product Requirements

01 64 00 - Owner-Furnished Products

01 77 00 - Closeout Procedures

01 78 39 - Project Record Documents

01 84 21 - Interior Concrete Floor Finishes Performance Requirements

01 91 13 - General Commissioning Requirements

01 92 00 - Facility Operation and Maintenance

DIVISION 03 – CONCRETE

03 20 00 - Concrete Reinforcement

03 30 00 - Cast-in-Place Concrete

03 45 00 - Precast Architectural Concrete

DIVISION 04 – MASONRY

04 20 00 - Unit Masonry

DIVISION 05 – METALS

05 12 00 - Structural Steel Framing

05 21 00 - Steel Joist Framing

05 31 00 - Steel Decking

05 40 00 - Cold-Formed Metal Framing

05 50 00 - Metal Fabrications

05 51 00 - Metal Stairs

05 70 00 - Decorative Metal

05 73 13 - Glazed Decorative Metal Railings

DIVISION 06 – WOOD AND PLASTICS

06 10 00 - Rough Carpentry

06 20 00 - Finish Carpentry

06 20 01 - Finish Carpentry Schedule

06 40 00 - Architectural Woodwork

06 40 01 - Architectural Woodwork Schedule

06 64 00 - Plastic Paneling

06 64 01 - Plastic Paneling Schedule

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 08 00 - Commissioning of Thermal and Moisture Protection

07 13 26 - Pre-Applied Sheet Membrane Waterproofing

07 14 50 - Fluid-Applied Waterproofing Membrane

07 21 00 - Thermal Insulation

07 24 19 - Water-Drainage Exterior Insulation and Finish System (EIFS)

07 27 01 - High Performance Vapor Retarder

07 27 26 - Fluid-Applied Membrane Air Barrier

07 42 00 - Metal Wall Panels

07 54 23 - Thermoplastic Polyolefin (TPO) Roofing

07 62 00 - Sheet Metal Flashing and Trim

07 72 33 - Roof Hatches

07 81 00 - Applied Fireproofing

07 84 00 - Firestopping

07 92 00 - Joint Sealants

07 95 00 - Preformed Traffic Durable Sealant Systems

DIVISION 08 – OPENINGS

08 08 00 - Commissioning of Openings

08 11 13 - Hollow Metal Doors and Frames

08 11 16 - Aluminum Doors and Frames

08 14 16 - Flush Wood Doors

08 31 13 - Access Doors and Frames

08 33 23 - Overhead Coiling Doors

08 38 00 - Traffic Doors

08 41 13 - Aluminum Framed Entrances and Storefronts

08 44 13 - Glazed Aluminum Curtainwalls

08 71 00 - Door Hardware

08 81 00 - Glazing

08 87 13 - Solar Control Film

DIVISION 09 – FINISHES

09 05 61 - Common Work Results for Flooring Preparation

09 21 16 - Gypsum Board Assemblies

09 21 17 - Gypsum Board Shaft Wall Assemblies

09 30 00 - Tiling

09 30 01 - Tiling Schedule

09 51 13 - Acoustic Panel Ceilings

09 51 14 - Acoustic Panel Ceilings Schedule

09 54 23 - Linear Metal Ceilings

09 62 38 - Tile Wet Area Surfacing

09 64 00 - Wood Flooring

09 64 01 - Wood Flooring Schedule

09 65 19 - Resilient Flooring

09 65 20 - Resilient Flooring Schedule

09 67 23 - Resinous Flooring

09 72 00 - Wall Coverings

09 72 01 - Wall Coverings Schedule

09 75 00 - Interior Stone

09 75 01 - Interior Stone Schedule

09 77 50 - Vertical Surfacing Panel System

09 84 30 - Sound Absorbing Wall and Ceiling Units

09 91 00 - Painting

09 91 01 - Painting Schedules

DIVISION 10 – SPECIALTIES

10 14 00 - Signage

10 21 13.16 - Plastic Laminate Toilet Compartments

10 22 36 - Coiled Wire Fabric and Attachment Systems

10 28 13 - Toilet and Bath Accessories

10 28 19 - Glass Shower Doors

10 44 00 - Fire Protection Specialties

DIVISION 11 – EQUIPMENT

11 08 00 - Commissioning of Equipment

11 21 73 - Commercial Laundry Equipment

11 40 00 - Food Service Equipment

11 40 01 - Food Service Equipment Schedule

11 66 00 - Athletic Equipment

DIVISION 12 – FURNISHINGS

12 36 00 - Solid Surfacing Countertops and Sills

12 92 00 - Artificial Plants

DIVISION 13 – SPECIAL CONSTRUCTION

13 08 00 - Commissioning of Special Construction

13 11 13 - Below Grade Swimming Pools

13 11 15 - Swimming Pool Finishes

13 11 16 - Swimming Pool Piping & Valves

13 11 46 - Swimming Pool Equipment and Accessories

13 24 16 - Saunas

13 24 16.24 - Prefabricated Exterior Saunas

DIVISION 21 – FIRE SUPPRESSION

21 01 00 - General Provisions for Fire Suppression

21 05 00 - Common Work Results for Fire Suppression

21 05 13 - Common Motor Requirements for Fire Suppression

21 05 29 - Hangers and Supports for Fire Suppression

21 05 53 - Identification for Fire Suppression

21 08 00 - Commissioning of Fire Suppression Systems

21 13 13 - Wet-Pipe Fire Suppression

DIVISION 22 – PLUMBING

22 01 00 - General Provisions for Plumbing

22 05 00 - Common Work Results for Plumbing

22 05 13 - Common Motor Requirements for Plumbing

22 05 19 - Meters and Gauges for Plumbing

22 05 23 - General-Duty Valves for Plumbing

22 05 29 - Hangers and Supports for Plumbing

22 05 33 - Heat Tracing for Plumbing

22 05 48 - Seismic Controls for Plumbing

22 05 53 - Identification for Plumbing

22 07 00 - Plumbing Insulation

22 08 00 - Commissioning of Plumbing Systems

22 11 16 - Domestic Water Piping

22 11 19 - Domestic Water Piping Specialties

22 11 23 - Domestic Water Pumps

22 13 16 - Sanitary Waste and Vent Piping

22 13 19 - Sanitary Waste Piping Specialties

22 14 16 - Facility Storm Drainage Piping

22 14 20 - Subdrainage

22 14 29 - Sump Pumps

22 31 00 - Water Softeners

22 33 00 - Electric Domestic Water Heaters

22 35 00 - Domestic Hot Water Heat Exchangers

22 40 00 - Plumbing Fixtures

22 52 13 - Steam Room Generators

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

23 01 00 - General Requirements for HVAC

23 01 30.51 - HVAC Air-Distribution System Cleaning

23 05 00 - Common Work Results for HVAC

23 05 13 - Common Motor Requirements for HVAC Equipment

23 05 16 - Expansion Fittings and Loops for HVAC Piping

23 05 17 - Sleeves and Sleeve Seals for HVAC Piping

23 05 19 - Meters and Gauges for HVAC Piping

23 05 23 - General-Duty Valves for HVAC Piping

23 05 29 - Hangers and Supports for HVAC Piping and Equipment

23 05 53 - Identification for HVAC Piping and Equipment

23 05 93 - Testing, Adjusting, and Balancing

23 07 13 - Duct Insulation

23 07 16 - HVAC Equipment Insulation

23 07 19 - HVAC Piping Insulation

23 08 00 - Commissioning of Mechanical Systems

23 09 34 - Variable-Frequency Motor Controllers for HVAC

23 11 23 - Facility Natural-Gas Piping

23 21 13 - Hydronic Piping

23 21 14 - Hydronic Specialties

23 21 23 - Hydronic Pumps

23 31 00 - HVAC Ducts and Casings

23 33 00 - Duct Accessories

23 34 23 - HVAC Power Ventilators

23 35 01 - Dryer-Vent Exhaust Collection Systems

23 36 00 - Air Terminal Units

23 37 13 - Diffusers, Registers, Grilles and Louvers

23 51 00 - Breechings, Chimneys and Stacks

23 52 16 - Condensing Boilers

23 57 00 - Hydronic Heat Exchangers

23 74 13 - Packaged, Outdoor, Air-Handling Units

23 81 26 - Split System Air Conditioning Units

23 82 19 - Fan Coil Units

23 82 39 - Electric Heaters

23 83 16 - Radiant-Heating (Snow & Ice Melt) Hydronic Piping

DIVISION 25 – INTEGRATED AUTOMATION

25 08 00 - Commissioning of Integrated Automation Systems

25 10 00 - IAS Network Systems

25 20 00 - IAS Instrumentation

25 30 00 - IAS Terminations

25 90 00 - IAS Sequence of Operations

25 95 00 - IAS Master Set Points List

DIVISION 26 – ELECTRICAL

26 05 00 - General Requirements

26 05 19 - Low-Voltage Electrical Power Conductors and Cables

26 05 26 - Grounding and Bonding for Electrical Systems

26 05 29 - Hangers and Supports for Electrical Systems

26 05 34 - Conduit for Electrical Systems

26 05 37 - Boxes for Electrical Systems

26 05 48 - Vibration and Seismic Controls for Electrical Systems

26 05 53 - Identification for Electrical Systems

26 05 73 - Power System Studies

26 05 83 - Wiring Connections

26 08 00 - Commissioning of Electrical Systems

26 09 23 - Lighting Control Devices

26 21 00 - Low-Voltage Electrical Service Entrance

26 27 26 - Wiring Devices

26 29 01 - Switchboards and Integrated Low-Voltage Distribution and Controls

26 51 00 - Interior Lighting

26 56 00 - Exterior Lighting

DIVISION 27 – COMMUNICATIONS

27 05 10 - Basic Requirements for Communications Systems

27 05 36 - Cable Trays for Communications Systems

27 08 00 - Commissioning of Communications Systems

27 11 00 - Communications Equipment Room Fittings and Pathways

27 12 00 - Identification for Communications Systems

27 12 50 - Operation, Maintenance, and Warranties for Communications Systems

27 13 00 - Structured Cabling General Requirements

27 13 50 - Structured Cabling for Voice and Data

27 15 00 - Communications Backbone Cabling

27 16 00 - Testing of Communications Systems

27 20 00 - Ambient Sound Distribution and Masking System

27 25 00 - Audio/Visual Systems and Displays

27 41 33 - Broadband Television Distribution System

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 08 00 - Commissioning of Safety and Security Systems

28 10 04 - Access Control Devices and Equipment

28 21 00 - Video Surveillance

28 31 11 - Digital Addressable Fire Alarm System

28 31 19 - Distributed Antenna System (Emergency Response)

28 31 20 - Distributed Antenna System (Internal Communication)

28 31 29 - Area of Refuge/Rescue Assistance Systems

DIVISION 31 – EARTHWORK

31 10 00 - Site Clearing

31 23 00 - Excavation and Fill

31 23 19 - Dewatering

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 13 13 - Concrete Paving

32 14 00 - Unit Paving

32 17 23 - Pavement Marking

32 18 23 - Synthetic Field Sport Surfacing

32 18 25 - Athletic Surfacing

32 31 19 - Decorative Metal Fences and Gates

32 33 00 - Site Furnishings

32 35 15 - Landscape Shade Tops

32 35 16 - Outdoor Shade Structures

32 84 00 - Planting Irrigation

32 92 00 - Turf and Grasses

32 93 00 - Plants

DIVISION 33 - UTILITIES

33 08 00 - Commissioning of Utilities

33 10 00 - Water Utilities

33 30 00 - Sanitary Sewerage

33 40 00 - Storm Drainage Utilities

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

41 22 00 - Hoists and Cranes

END OF SECTION

SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.01 DOCUMENT INCLUDES

A. Information that is made available to Bidders is for reference only, and is not intended to be part of the Contract.
   1. **Existing Building Drawings (Available on Procore)**

1.02 USE OF INFORMATION PROVIDED

A. Bidders are encouraged to review information available to Bidders prior to submitting a Bid, and obtain additional information if Bidder desires.

B. Owner will not consider requests for additional compensation for extra Work due to conditions that reasonably could have been anticipated from the information provided.

1.03 INTERPRETATION

A. Owner supplied information is provided only for information and convenience to Bidders. Owner and Architect disclaim responsibility for accuracy of information that has been prepared by others. Owner and Architect further disclaim responsibility for interpretation of that information by Bidders.

1.04 EXISTING BUILDING DRAWINGS

A. ***Owner has made drawings of the existing building available on the project website (Procore).***

B. ***Owner does not warrant conditions of existing building as it currently exists. Drawings are provided for reference only and does not relieve Contractors of obligation to provide field verification.***

C. ***Parties using existing drawings described in this Document accept full responsibility for its use and obtaining additional information that may be required.***

D. ***Extra Payment Limitations: No consideration for extra payment will be given for conditions occurring that could have been anticipated from information provided. If conditions occur resulting in extra Work that could not have been anticipated or reasonably inferred from the information, Conditions of the Contract for changes in Work will apply.***

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

ATTACHMENTS

EXISTING BUILDING DRAWINGS

END OF SECTION

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SECTION 00 40 00
CONTRACT PACKET FORMS

PART 1 - GENERAL

1.01 USE OF INFORMATION PROVIDED

A. Bidders are urged to examine the information provided, make their own investigation of the Sample Contracts, required insurances, and forms before bidding, and obtain additional information should they desire.

1.02 CONTRACT PACKET FORMS

A. The General Contractor will furnish a “Bid Manual” that will contain relevant project information, directives and forms for the work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 43 25

SUBSTITUTION REQUEST FORM

1.1 SUBSTITUTION REQUESTS

Life Time Property Development welcomes and encourages substitution requests in order to reduce costs. Any and all substitution requests should be considered an equal to the work identified and products specified. All substitutions shall be identified and submitted with their Bid using the substitution request form that is attached to this Section. If a sample submission is required by the product specification, submit the sample along with the substitution request.

SUBSTITUTION REQUEST FORM

To: **Life Time Construction**
2900 Corporate Place
Chanhassen, MN 55317 PH: (952) 229-7521 FAX: (952) 995-0276

SECTION #	PARA #	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION

REASON FOR SUBSTITUTION:

ATTACH COMPLETE TECHNICAL DATA, LITERATURE AND SAMPLE IF APPLICABLE

A. Does proposed substitution fail to satisfy, in any respect, characteristics specified for original product(s)?..... [Y] [N]

B. Does substitution affect dimensions shown on drawings?..... [Y] [N]

C. Does substitution affect other trades?..... [Y] [N]

D. Does warranty differ from that specified?..... [Y] [N]

E. Does substitution affect the schedule ..... [Y] [N]

F. Does substitution affect cost to Owner?..... [Y] [N]

If so, how much? Add $_____ Deduct $_____

G. If you indicated "Yes" to any of the items above, attach thorough explanation on your Company letterhead as follows:

a. Explain any differences between proposed substitution and specified product.

b. Summarize experience with product and manufacturer in Project area.

The undersigned states that the function, appearance and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The undersigned agrees that, if necessary, in the sole opinion of the Architect/Engineer, to make this product perform as intended all additional costs shall be paid by the contractor.

Submitted by: _____

Position: _____

Company: _____

Address: _____

Date: _____

Telephone: _____

For use by Architect:

Accepted: .....

Accepted As Noted: .....

Not Accepted: .....

Received Too Late: .....

By

Date

Signature: _____ Remarks

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SECTION 00 52 00
AGREEMENT FORM

PART 1 GENERAL

1.01 FORM OF AGREEMENT

A. The Agreement to be executed is attached following this page.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 00 72 00
GENERAL CONDITIONS

PART 1 GENERAL

1.01 FORM OF GENERAL CONDITIONS

A. The General Conditions applicable to this contract is attached following this page.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 00 10
DIVISION 1 TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00 - Summary of Work
01 31 00 - Project Management and Coordination
01 31 01 - Project BIM Coordination
01 31 02 - BIM Coordination Sign-off
01 33 00 - Submittal Procedures
01 33 01 - Sample Submittal Log
01 40 00 - Quality Requirements
01 43 39 - Mockups
01 45 33 - Code Required Special Inspections and Procedures
01 45 34 - Special Inspections Acknowledgement Form
01 60 00 - Product Requirements
01 64 00 - Owner-Furnished Products
01 77 00 - Closeout Procedures
01 78 39 - Project Record Documents
01 84 21 - Interior Concrete Floor Finishing Performance Requirements
01 91 13 - General Commissioning Requirements
01 92 00 - Facility Operation and Maintenance

END OF SECTION

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL INFORMATION

A. A basic summary description of the project is as follows:

An approximately 60,500 SF health club comprising of two above ground levels and an outdoor pool deck. Project facilities to include indoor & outdoor pools, café, fitness equipment, office, spa, short-term childcare, and gymnasium.

B. General contract information, procedures, requirements, restrictions, directions and forms for all subcontractors will be provided by the Owner prior to work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination drawings.
   2. Requests for Information (RFIs).
   3. Project Web site.
   4. Project meetings.

1.02 RELATED SECTIONS:

A. 01 31 00.05 - Project BIM Coordination for work to be coordinated by Building Information Management software.

B. 01 77 00 - "Closeout Procedures" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.03 DEFINITIONS

A. RFI: Request for Information; a request for an owner, architect and contractor to request further information from each other during construction.

B. PR: Proposal Request; a request to the contractor for price and time quotations related to a proposed change in the construction contract.

C. CCD: Construction Change Directive; a directive for changes in the Work for use where the owner and contractor have not agreed on proposed changes in the contract sum or contract time. Upon receipt of a CCD, the contractor must promptly proceed with the change in the Work described therein.

D. ASI: Architect's Supplemental Instruction; a means for the Architect to provide additional instructions, interpretations, or order minor changes in the Work that do not constitute a change to the contract sum or contract time.

1.04 COORDINATION

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 separate Subcontractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures via Owner-approved and provided project management website/software with other construction activities and activities of other Subcontractors 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 and its coordination with the Owner's milestones.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.
5. Special Inspections.
6. Progress meetings.
7. Pre-installation conferences.
8. Facilitate weekly project team meetings.
9. Startup and adjustment of systems.
10. Project closeout activities.

1.05 COORDINATION DRAWINGS AND BIM MODELS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, 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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. 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 Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
   2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes as well as locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Review: General Contractor (GC) and Owner’s Representative (OR), or agent thereof, will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Subcontractor's responsibility.

C. Coordination BIM Models: See Section 01 31 01 Project BIM Coordination.

1.06 REQUESTS FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Subcontractor shall prepare and submit an RFI in the form specified.
   1. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Subcontractor's work.
   2. Submit RFIs electronically via Procore software system.
      a. General Contractor (GC) will assign each subcontractor a site username and password once contract documents have been executed. An email will be sent to the subcontractor with information and directions for the site access.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Name of Subcontractor.
   4. RFI number, numbered sequentially.

5. RFI subject.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Subcontractor's suggested resolution. If Subcontractor's solution(s) impacts the Subcontractor Time or the Subcontractor Price, Subcontractor shall state impact in the RFI.
10. Subcontractor's signature.
11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Submit electronically via Procore software system.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 3-5 working days for General Contractor's response for each RFI, or up to 10 working days for RFIs requiring coordination with multiple disciplines. RFIs received by General Contractor after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Subcontractor Time or the Subcontractor Price.
   e. Requests for interpretation of general Contractor's actions on submittals.
   f. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case the time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Subcontractor Time or the Subcontractor Price may be eligible for Subcontractor to submit Change Proposal according to conditions of the contract and as otherwise specified.
   a. If Subcontractor believes the RFI response warrants change in the Subcontractor Time or the Subcontractor Price, notify the Architect and Owner's Representative in writing within 5 days of receipt of the RFI response.

1.07 PROJECT WEB SITE

A. All project coordination will be handled via email and other digital methods as advised. Provide email addresses for all appropriate project staff.

1.08 PROJECT MEETINGS

A. General: General Contractor will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

B. Preconstruction Conference: General Contractor will schedule and conduct a preconstruction conference before starting construction.
1. Attendees: Architect, Owner's Representative, General Contractor, Subcontractor's Project Manager 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.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for RFIs.
   g. Procedures for testing and inspecting.
   h. Procedures for processing Applications for Payment.
   i. Distribution of the Contract Documents.

j. Submittal procedures.
k. Sustainable design requirements.
l. Preparation of record documents.
m. Use of the premises.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.
aa. Safety
bb. Owner Requirements

3. Minutes: General Contractor will record and distribute meeting minutes.

C. Pre-installation Conferences: General Contractor shall conduct a pre-installation 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 General Contractor, Architect, and Owner’s Representative of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

z. Safety Action Plan.
aa. Site Coordination.

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. Progress Meetings: General Contractor will conduct progress meetings at weekly intervals.
1. Attendees: In addition to the Architect, Owner's Representative, and General Contractor, each Subcontractor, Sub-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.
2. 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. Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to 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 so as not to delay the completion of the Project.
1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of testing and inspections.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.
20) Safety.
21) Site Clean Up.
3. Minutes: General Contractor will record and distribute the meeting minutes to each party present and to parties requiring information.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 31 01
PROJECT BIM COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building Information Modelling Standards and Coordination.
   1. Protocols for 3D Coordination.
   2. Model content and expected Level of Detail.
   3. Model Element Scope.

1.02 RELATED REQUIREMENTS

A. Section 01 31 00 - Project Coordination.

B. Section 01 77 00 - Closeout Procedures: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

C. Division 5 - Metals: See below for scope.

D. Section 11 40 00 - Food Service Equipment

E. Division 21 - Fire Suppression: See below for scope.

F. Division 22 - Plumbing: See below for scope.

G. Division 23 - Heating, Ventilation and Air Conditioning (HVAC): See below for scope.

H. Division 26 - Electrical: See below for scope.

I. Division 32 - Exterior Improvements: See below for scope.

1.03 ADDITIONAL CONTRACTING CONDITIONS

A. BIM modelling and coordination is a condition of the contract and the cost to the subcontractor is to be included in the cost of construction.

B. This specification is written with the assumption that Life Time is serving as General Contractor. When this is not the case, the General Contractor shall take on the role of BIM Model Coordinator.

C. Failure by Subcontractors to uphold the obligations specified herein shall be considered a material breach of the Subcontract.
   1. In the event of any such breach, Life Time may, upon 48 hours' notice to Subcontractor, supplement Subcontractor's work required herein at Subcontractor's expense and exercise any and all other remedies provided under the Subcontract or applicable law.
      a. Subcontractor will be liable for lost time to Life Time or other Subcontractors.
      b. Subcontractor will be liable to correct any improperly coordinated work, whether by themselves or by other Subcontractors.

D. Submission of required models in a timely manner and their coordination serves to reserve space for each Subcontractor to install their Scope of Work components.
   1. Subcontractors who fail to completely submit their models in a timely manner shall be required to move their components, at their own expense, in the event of conflict with another Subcontractor.

1.04 DEFINITIONS

A. **Building Information Model.** A Building Information Model is a digital representation of the physical and functional characteristics of the Project which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components. The Building Information Model is herein referred to as the "Model(s)". "Building Information Modeling" (BIM) refers to the methodology and technology used to create the Model. The following types of models will be used during the coordination effort:
   1. **Design Models.** Design Models are provided by Life Time to the subcontractors that includes both the Architectural and Structural elements of the Project. This model will be created by the

Architect and Engineer of Record. The Level of Detail of the Base Construction Model shall be established prior to the BIM Kickoff Meeting.

2. **Coordination Model.** The Coordination Model is the Model that will be reviewed by Life Time and its subcontractors on an ongoing basis until the time a “Sign-off Model” is completed. This Model will include the design models and Subcontractor Model Elements that have been provided.
3. **Sign-off Model.** The Sign-off Model is the final Coordination Model which becomes the basis for construction from which shop drawings and field drawings are to be produced. This Model may consist of the entire Project or only an area or level of the Project.
4. **As-Built Model.** A Model that reflects the As-Built condition of the Project. This Model type will be used following coordination to represent the install condition of the Model Elements. It will include the Base Construction Model and all Subcontractor Model Elements.

B. **Clash Detection.** Clash Detection tools enable effective identification, inspection, and reporting of interference clashes in a 3D project model.

C. **Level of Detail.** The Level of Detail (LOD) describes the particular level of completeness to which a Model Element or Subcontractor Scope of Work is to be developed. Further information is found in the AGC BIM Specification (2016).

D. **Model Element.** A Model Element is a portion of the Building Information Model representing a component, system or assembly within a building. For the purposes of this Specification, Model Elements are represented by the different systems included in each Subcontractor’s Scope of Work.

E. **Model Element Author.** The Model Element Author (MEA) is the party responsible for developing the content of a specific Model Element to the LOD required for Subcontractor's particular scope of Work on the project. Model Element Author refers to the subcontractor responsible for an identified Scope of Work.

F. **Navisworks® Freedom.** Autodesk® Navisworks® Freedom software is the free viewer for files in the Navisworks® NWD and 3D DWF formats. Navisworks® Freedom is to be utilized by the Model Element Author to review clashes between Model Elements.

G. **Navisworks® Manage.** Autodesk® Navisworks® Manage software will be used to create a single Model of the Project from the individual Model Elements developed by the Model Element Authors to provide a real-time project view for effective 3D Coordination and 4D planning. Navisworks® Manage provides the tools to optimize interoperability between all types of models, regardless of format or file size, and perform Clash Detection for coordination review.

H. **Object Enabler.** A downloadable module that ‘translates’ the BIM model custom objects into a language that other software applications understand.

1.05 REFERENCE STANDARDS

A. AGC BIM Level of Specification - AGC BIM LoS; 2016.

B. NBIMS-US v3 - National BIM Standards-US; Version 3.

C. NCS v6 - National CAD Standards (NCS); Version 6.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination Protocol:
   1. Kick-off Meeting:
      a. After award, a 3D Coordination protocol meeting shall be held.
      b. All Subcontractors to be involved in the 3D Coordination effort are required to attend. Attendees shall include at least one Project Manager and one member of the 3D modeling team from each Subcontractor.
      c. Coordination requirements, Schedule, Standards and other related items shall be discussed.
   2. Training:
      a. Life Time may, at its discretion, provide basic coordination training for all coordination team members (if necessary).

b. Complete, accurate, and timely modeling and submission of Subcontractor's work shall remain the responsibility of Subcontractor.

3. Internal Coordination:
   a. The Subcontractor's Model Elements shall be internally coordinated prior to submitting to Bim Model Coordinator.
   b. Internal Coordination shall include all elements of the Subcontractor's Scopes of Work, any existing work of the same Scopes of Work as the subcontractor's, or connections to other Scopes of Work by the Subcontractor.
4. Coordination with Provided Information:
   a. The Subcontractor's Model Elements shall be coordinated with the provided information prior to submitting to Bim Model Coordinator.
   b. Coordination shall include all elements of the Base Construction Model, adherence to any plenum / underground hierarchy diagrams on the project, and any available Trade / Subcontractor models of other Scopes of Work in provided Coordination Models.
   c. All subcontractors shall coordinate their scopes of work with the contract documents.
5. Conflict Corrections:
   a. The Model Element Authors shall correct all assigned Model Element conflicts discovered during or after Bim Model Coordinator's review of submitted models or Coordination meetings prior to the following submittal deadline or coordination meeting.
6. Model Management:
   a. Bim Model Coordinator will facilitate the Coordination Process throughout the duration of the Project. Bim Model Coordinator will provide the following:
      1) Model Coordinate System (Origin, Orientation and Units)
      2) Collaboration Site (Setup and Maintenance)
      3) Process for transferring and accessing Model files.
      4) Naming Conventions for subcontractor file names
      5) Typical Plenum Hierarchy Diagram
      6) Coordination Schedule. A detailed schedule for 3D coordination will be coordinated with the overall project schedule. This schedule will be issued at the time of the Kick-off meeting.
   b. During the project, Lifetime will manage the following processes:
      1) Coordinate submission and exchange of Models
         (a) Validate that files are complete, usable and in compliance with applicable protocols
         (b) Maintain record copy of each file received
      2) Create Coordination Model
      3) Perform Clash Detection between trades
      4) Facilitate Coordination Meetings
      5) Issue Requests for Information for conflicts requiring Design Team input
      6) Publish Coordination Meeting models and reports for subcontractor review and resolution
      7) Maintain an updated coordination schedule
      8) Maintain Sign-Off Models and As-Built Models.
7. Model Ownership:
   a. All Models submitted to or by Bim Model Coordinator may be used as needed by the Project Team; however, only the original Model Author has the right to modify Model content.
   b. By submitting content for the Model, Bim Model Coordinator and/or the Subcontractor does not grant any ownership right in the content provided or in the software used to produce content.
   c. In addition to the uses defined in this Specification (design, coordination, fabrication, and construction of the Project) these Models may also be used for other purposes such as 4D scheduling and facility maintenance by either Bim Model Coordinator or Owner.
8. Collaboration Site:
   a. All file transfers for coordination will be via the file sharing site provided by Life Time.

b. The standard file sharing location for Life Time is ProCore.

9. Clash Detection:
   a. Prior to established deadlines or Coordination Meetings, Navisworks will be used to identify conflicts between trades.
   b. Additional issues and clashes may also be found while virtually walking the Project. Subcontractors are responsible for performing internal and external coordination as defined in 1.06A4 prior to submitting models to Bim Model Coordinator.
10. Clash Viewpoints:
   a. Clashes and issues will be documented in the model and provided to all Coordination team members as a basis for tracking progress in the coordination process. These viewpoints will be provided after Bim Model Coordinator's review of subcontractor submissions or after scheduled Coordination Meetings.
   b. Clashes and issues will all receive a number, and a designation of which company is responsible for the resolution.
   c. If an RFI is issued in the process of resolving a clash or issue, the RFI# will also be noted in the Clash Report. Subcontractors will resolve all documented clashes and issues in the reports prior to the following submittal deadline or Coordination meeting.
   d. The viewpoints will serve as a basis for tracking performance of the coordination process.
11. Model and Report Distribution:
   a. Bim Model Coordinator will provide the Coordination Model and Clash Report to each Subcontractor via the Collaboration Site for their review and use in the External Coordination process or to make the required changes to their Model Elements after Coordination Meetings and other deadlines as defined by the BIM Coordination Schedule.
12. External Coordination:
   a. As Subcontractor models are added to the Coordination Model, the Subcontractor will use the Coordination Model and Clash Reports provided to coordinate their Scope of Work with all other Subcontractors' Scopes of Work.
   b. Subcontractor shall communicate with the other trades / subcontractors to resolve clashes that do not require Bim Model Coordinator's involvement as a facilitator.
   c. Each subcontractor shall make the necessary changes and upload their revised models to confirm that the conflicts are resolved.
   d. Submission deadlines for these externally coordinated models shall be in accordance with the Coordination Schedule established by Life Time and as otherwise required by Life Time in the Coordination Schedule.
   e. Bim Model Coordinator will confirm that submitted models meet the internal and external coordination requirements prior to the scheduled Coordination Meeting.
13. Coordination Meetings:
   a. The Subcontractor shall be prepared to accommodate Coordination meetings to resolve model conflicts.
      1) The scheduled meetings will take place on the jobsite at a location and time to be determined by the Project Team and may consist of either recurring meetings or 2 or 3 day work sessions.
   b. During each meeting the current Coordination Model will be reviewed by virtually walking the Project and discussing conflicts found using Clash Detection and model viewing tools.
   c. Each conflict found will be discussed with all involved parties to determine the best solution, with Life Time acting as the facilitator for those discussions.
      1) Attendees shall include at least one Model Element Author from each Subcontractor who clearly understands the defined Scope of Work and is able to make decisions about changes to the Scope of Work in the meeting.
   d. Coordination Meetings may be conducted via Online Meeting depending on the location and accessibility of the jobsite by the Subcontractors. This will be determined by Life Time and will be based on the productivity of past online meetings.
14. Sign-Off Model:

a. Upon completion of Coordination, Subcontractor shall provide a model of the condition of their Scope of Work.
b. Model Elements shall be updated to include changes made by 1) Requests for Information, 2) Design changes by Architect / Engineer, 3) Submittal comments and revisions on approved shop drawings, and 4) As-Built field modifications.
c. After all conflicts have been corrected and/or Life Time and the Subcontractors agree that the area defined by the Coordination Model has been sufficiently coordinated, all parties will sign-off on the defined area using the 3D Coordination Sign-Off document (Attachment A).
d. This final Coordination Model then becomes the Sign-Off Model for the defined area. Any unresolved clashes or issues in this area that require further review (due to delayed responses or expected contract document changes) should be noted on the document.
e. The Subcontractor agrees to be responsible for locating their respective systems based on the Sign-Off Model.
    1) Any variation from this Sign-Off Model must be coordinated with Life Time.
    2) Components that are installed in conflict with the Sign-Off Model layout and create obstacles or additional work for other disciplines shall require one of the following: a) removal and reinstallation per model, or b) monetary compensation to the affected party.

15. Model Revisions:
    a. If the contract documents or the Subcontractor's Scope of Work are modified after the Sign-Off Model has been completed, the Subcontractor shall include costs within their Change Order to modify and re-coordinate the affected Model Elements in the modified areas.
    b. Substantial changes involving multiple trades may require additional Coordination Meetings, a new Sign-Off Model, and another Sign Off document.
    c. All coordination costs associated with the changes must be included in the Change Order for the changed Scope of Work. Subcontractor must notify the Project Model Manager of any changes to floors which have already been signed-off.
16. Shop Drawing Submittals of affected scopes of work:
    a. All submittals for affected Scopes of Work shall conform with the approved Sign-Off Model.
    b. See "Submittals" below.
17. Field/Installation Documents
    a. Field/Installation documents are to be based on the approved Sign-Off Model and are to include any mark-ups from the approved shop drawing submittal.
    b. These drawings are to be adequately dimensioned and labeled to accurately locate components in the field according to the coordinated Sign-Off Model.
18. Installation
    a. Subcontractors shall be responsible for quality assurance that all components (materials and equipment) installed are being placed in the field in accordance with the Sign-Off Model, Approved Shop Drawings and construction tolerances.
    b. Subcontractors shall utilize established benchmarks (coordinated by field personnel) for the installation of all components.
    c. Laser scanning and/or surveying equipment may also be used as a quality control mechanism to validate installation conforms with the Sign-Off Model.

B. Subcontractor Model Requirements:
1. Subcontractor shall deliver a Model that is on-time, accurate, and representative of the actual elements that will be or are installed in the field.
2. Any elements not included in the Subcontractor Model will become the Subcontractor's responsibility to coordinate in the field at no additional cost to Life Time, the Owner, or other subcontractors affected by the inaccurate or incomplete information.
3. File Formats. Subcontractor shall provide Life Time with a Model in a format acceptable to Navisworks®. Life Time would also prefer to receive a DWG when possible, however all file types mentioned in the following table are acceptable.
    a. Additional file formats to be approved by Life Time.

Format	Extension

Navisworks	.nwd .nwf .nwc
AutoCAD	.dwg .dxf
Revit	.rvt (An .nwc must be accompanied by the Revit file)
IFC	.ifc
Inventor	.ipf .iam .ipi

4. Model Origin:
   a. Subcontractor shall model their scope Model Elements on the base coordinate system set by Life Time in the provided Architectural/Structural Base Construction Model.
5. Object Enablers:
   a. Subcontractor shall provide download location of all Object Enablers (OE) required for custom objects to be displayed correctly outside of the Subcontractor's authoring application software.
6. Model Extent Requirements:
   a. The Model Elements provided by the Subcontractor shall extend to five feet beyond the exterior walls of the building, unless the specific Scope of Work (i.e., Civil, Landscape, Irrigation, etc.) to be modeled is intended to be outside the building footprint.
   b. Vertically, the Model Elements shall extend from the lowest extent of the foundations up through (and including) the roof of the upper most floor. To the extent that the Scope of Work includes building systems, those systems will be included to the full horizontal and vertical extents of the model including all systems in the soffits and roof-top mounted items.
7. Level of Detail:
   a. The Subcontractor's Model Elements shall include, at a minimum: all systems and components modeled to a Level of Detail consistent with objects represented by a 1/8" plan/elevation/section drawing. See Requirements for specific scopes of work below.
8. Model Clarity:
   a. The Subcontractor's Model shall be organized so that Model Elements can be clearly identified by name and/or layer by the Project Team and Owner.
   b. Subcontractor shall provide Life Time with their standard Model Element naming conventions and layer structure at Kick-Off meeting for approval.

C. Model Element Scope:
1. Model Element Scope. The following sections define the specific Model Element Scope for each Scope of Work. The Model Elements defined below are the minimum requirements; Subcontractor shall incorporate Model Elements beyond the scope below if they deem it necessary for proper coordination.
2. HVAC Scope of work: Specific dimensional locations of HVAC/Mechanical Systems may not be included in the Construction Documents; to the extent that location can be determined from the Construction Documents, the Model Elements are to reflect that location.
   a. Duct and Associated Equipment. All ducts, including joints and hangers, smoke dampers, fire dampers, diffusers, registers, grilles, air handling equipment, etc. are to be included. Ducts shall be modeled to the outside face dimension; support mechanisms shall be modeled. Flexible systems smaller than 1" are not required to be modeled; however, it is encouraged.
   b. Mechanical Equipment. Equipment shall be modeled to its overall height, width, and depth. All support mechanisms shall be modeled.
   c. Piping. All piping, such as condensate, associated with the mechanical equipment shall be modeled and should include fittings and connections, insulation, and support mechanisms. Piping smaller than 1" that does not require gravity slope may be excluded from the model. All valves and clean-outs shall be modeled and specially identified to allow them to be readily found.
   d. Electrical Requirements. Any electrical associated with HVAC shall be modeled to the line side of disconnect.

e. Maintenance / Clearance Access. Maintenance access areas and all other code required clearance areas associated with Model Elements shall be modeled
    1) Include all access doors in walls and ceilings.
    2) The access/code required clearance areas shall be modeled to the full extent of the access location (ex. VAV access zones shall be modeled to the ceiling/floor below to ensure clear and free access).
    3) Access elements shall be clearly identified in the Model and assigned a unique CAD layer or object material.
f. Penetrations / Sleeves. Sleeves shall be modeled if penetrations through building systems such as cast-in-place concrete and CMU walls require a sleeve per the Specifications.

3. Plumbing Scope of Work: Specific dimensional locations of Plumbing Systems may not be included in the Construction Documents; to the extent that location can be determined from the Construction Documents, the Model Elements are to reflect that location.
    a. Piping. All plumbing piping requiring gravity slope as well as all specialty piping (i.e., medical gas) shall be modeled to the outside diameter of the pipe with any pipe insulation (on a separate CAD Layer/Model Object) clearly defined and should include fittings, connections, hangers, and slope. Piping smaller than 1” (not including insulation) that does not require gravity slope may be excluded from the model, however modeling such pipes is encouraged to reserve space. All valves and clean-outs shall be modeled and specially identified to allow them to be readily found.
    b. Plumbing Equipment. All plumbing equipment shall be modeled to its overall height, width, and depth. All support mechanisms shall be modeled.
    c. Maintenance / Clearance Access. Maintenance access areas and all other code required clearance areas associated with Model Elements shall be modeled.
        1) Include all access doors in walls and ceilings. Access elements are to be clearly identified in the Model and are to be assigned a unique CAD layer or object material.
    d. Penetrations / Sleeves. Sleeves shall be modeled if penetrations through building systems such as cast-in-place concrete and CMU walls require a sleeve per the Specifications.
    e. Gravity Slope Requirements. Plumbing systems requiring gravity sloping are to be identified with object parameters or placed on separate layers.
4. Electrical Scope of Work: Specific dimensional locations of Electrical Systems may not be included in the Construction Documents; to the extent that location can be determined from the Construction Documents, the Model Elements are to reflect that location.
    a. Equipment. All Electrical Equipment shall be modeled to its overall height, width, and depth.
        1) Include switch gears, transformers, generators, panels, etc. All support mechanisms are to be modeled. All power feeds to equipment will be modeled.
        2) All support mechanisms shall be modeled.
        3) All power feeds to equipment shall be modeled.
    b. Cable Tray and Conduit. All Cable tray and gangs of conduit shall be modeled as well as individual conduits 1” or larger.
        1) Electrician will be responsible for modeling all electrical associated with HVAC from the point the Mechanical Subcontractor stops (line side of disconnect).
        2) Flexible systems smaller than 1” are not required to be modeled.
5. Fire Protection Scope of Work:
    a. Equipment. All equipment, such as fire pumps, associated with the Fire Protection system shall be modeled.
    b. Piping. All Fire Protection piping, including fittings, connections, slopes, valves, and sprinkler heads shall be modeled.
        1) Support mechanisms shall be modeled.
        2) Include Temporary standpipe
    c. Maintenance / Clearance Access. Maintenance access areas and all other code required clearance areas associated with Model Elements shall be modeled;
        1) Include all access doors in walls and ceilings.

2) Access elements shall be clearly identified in the Model and assigned a unique CAD layer or object material.

d. Penetrations / Sleeves. Sleeves are to be modeled if penetrations through building systems such as cast-in-place concrete and CMU walls require a sleeve per the Specifications.

6. Steel Scope of Work:
   a. The structural steel fabricator shall model their Scope of Work, including all structural and miscellaneous steel in detail.
      1) Include columns, beams, bolted connections, gusset plates, stairs, equipment supports, embeds, and other miscellaneous supports.
7. Food Service Scope of Work:
   a. The food service equipment provider shall model their Scope of Work.
      1) Include all equipment, with locations of necessary electrical/gas/ventilation hook ups.
      2) Include furniture, worktops, clear space, etc.

1.07 SUBMITTALS

A. Coordination Submissions.
   1. Subcontractor is to issue their current Model by the scheduled submission deadlines as spelled out in the 3D Coordination Kick-off Meeting and as otherwise required by the Project Schedule or Life Time.
   2. The Subcontractor's model shall conform to the established coordinate system and units.
   3. The Subcontractor shall issue their models per the defined naming convention.
   4. Bim Model Coordinator will combine all Subcontractor Models with the Construction Base Model to create the Coordination Model(s).

B. Shop Drawing Submittals of affected Scopes of Work.
   1. Shop Drawing submittals to the engineer/architect shall be provided as required by the specifications and are to be based on the approved Sign-Off Model.
      a. These submittals are to be issued following the completion and sign-off of the Coordination Model for the designated area. In some instances, the coordinated Subcontractor Model may also be requested by the Design team for review.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

ATTACHMENTS

ATTACHMENT A: 3D COORDINATION SIGN-OFF

END OF SECTION

Attachment A

3D Coordination Sign-Off
Area(s) Being Finalized: _____

Statement of Coordination Completion:
Life Time and the Subcontractors listed below confirm that the Navisworks model dated_____for the area(s) being finalized of the Project noted above has been satisfactorily coordinated between all trades of the MEP systems and the Architectural & Structural elements. The design elements of this model are based on the current Construction Documents dated_____.

Subcontractor agrees to prepare field drawings and install their respective components per the coordinated model. Any variations and/or conflicts in the field between coordinated elements will be reviewed by Life Time to determine fault. Components that are confirmed to be installed in conflict with the coordinated model layout and create obstacles or additional work for other disciplines shall require one of the following actions: a) removal and reinstallation per model, or b) monetary compensation to the affected party.

Changes occurring to the Construction Documents following sign-off will be treated on a case-by-case basis, but typically changes will be the responsibility of Subcontractor to coordinate with the signed-off model. Any changes made by Subcontractor should be reflected in their next Model submitted to Life Time. When necessary, Life Time will request revised models in order to coordinate the changes prior to install.

Contractor -

Signature: _____ Date: _____

Name / Title: _____

HVAC, Plumbing, Mechanical Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Initial_____

Electrical Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Fire Protection Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Steel Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Glazing Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Initial_____

Other Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Other Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Other Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Other Subcontractor

Company Name: _____

Project Manager Signature: _____ Date: _____

Project Manager Name: _____

Foreman Signature: _____ Date: _____

Foreman Name: _____

Initial_____

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

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

1.02 RELATED SECTIONS:

A. Section 01 11 00 - Summary of Work for submitting schedules and reports, including Contractor's construction schedule.

B. Section 01 40 00 - Quality Requirements for informational submittals related to testing of materials.

C. Section 01 43 39 - Mockups, for requirements of mockups.

D. Section 01 60 00 - Product Requirements for product requirements for submittals.

E. Section 01 92 00 - Facility Operation and Maintenance.

F. All Divisions 2-33 for individual submittal requirements.

G. Applicable conditions of the General Contractor Subcontract.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect’s and General Contractor’s responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect’s and General Contractor’s responsive action. Submittals may be rejected for not complying with requirements.

1.04 ACTION 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 modifications to submittals noted by the Architect and General Contractor and additional time for handling and reviewing submittals required by those corrections.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. 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. Coordinate transmittal of different types of submittals for related parts of the Work so processing is not delayed because of need to review submittals concurrently for coordination.
      a. Architect and General Contractor reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect’s receipt of submittal. No extension of the Subcontract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
   1. Submittal Review: Allow 5-10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise General Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Re-submittal Review: Allow 5-10 business days for each resubmittal.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Subcontractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
    a. Project name.
    b. Name of subcontractor.
    c. Name of supplier.
    d. Name of manufacturer.
    e. Submittal number or other unique identifier, including revision identifier.
    f. Number and title of appropriate Specification Section.
    g. Drawing number and detail references, as appropriate.
    h. Location(s) where product is to be installed, as appropriate.
    i. Other necessary identification.

D. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than General Contractor.
1. Transmittal Form: Include Transmittal Form with Company Letterhead.
2. On an attached separate sheet, prepared on Subcontractor'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.

E. Re-submittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmittals, if necessary, shall cloud and clearly identify revisions from previous submittals.
4. Resubmit submittals until they are marked with approval notation from General Contractor’s and Architect’s action stamp.

F. Use for Construction: Use only final submittals that are marked with approval notation from General Contractor’s and Architect’s action stamp.

PART 2 PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:
1. Submit electronically via Procore website.
    a. General Contractor will assign each subcontractor a site username and password once contract documents have been executed. An email will be sent to the subcontractor with information and directions for the site access.
    b. Physical samples must be delivered to General Contractor for any submittal showing kind, color, textures and/or patterns for the architect to approve. A picture of physical sample is to be included with electronic submittal package, for record and mark-up purposes.
2. Action Submittals: Submit electronically via Procore website. Submittals shall be returned via the same website.
3. Informational Submittals: Submit electronically via Procore website. Submittals shall be returned via the same website, if applicable.
4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section 01 77 00 "Closeout Procedures."
5. 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. Provide a notarized statement on original paper copy certificates and certifications where indicated.

6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section 01 40 00 "Quality Requirements."

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 submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. 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 via website provided by Owner’s Representative, in PDF format.

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. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Format: Provide shop drawings in the following format, if applicable:
      a. Cover Sheet with ample room for approval/review stamp.
      b. Shop Drawing Index, if multiple sections or submittals are being submitted.
      c. Bind all PDF sheets into one file.
         1) PDF files shall be bookmarked and searchable.
      d. Cloud deviations from construction documents.
      e. Cloud changes on re-submittals.
   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 but no larger than 24 by 36 inches.
   4. Submit Shop Drawings via website provided by Owner’s Representative, in PDF format.

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. **Sample Submittals may be waived for interior finishes if the specified material is supplied without variation, at the discretion of the Architect.**

2. Transmit Samples that contain multiple, related components such as accessories together in one submittal package. Include a photo record within electronic submittal package, uploaded to website provided by Owner's Representative.
3. 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.
        1) If multiple materials are specifed in one Specification Section, identify each sample according to the specified material name or code.
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.
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 1 full set 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. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 3 of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
    1. Submit product schedule via website provided by Owner's Representative, in PDF format.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section 01 11 00 "Summary of Work."

G. Application for Payment: Comply with requirements specified in Division 0 Section 00 52 00 – Agreement Forms and Division 0 Section 00 72 00 – General Conditions.

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. 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.
    1. Submit subcontract list via website provided by Owner's Representative, in PDF format.

J. Coordination Drawings: Comply with requirements specified in Division 1 Section 01 31 00 "Project Management and Coordination."

K. 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.

L. 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 American Welding Society (AWS) forms. Include names of firms and personnel certified.

M. 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.

N. 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.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. 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.

R. Product Test Reports: Submit written reports indicating 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.

S. 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.

T. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section 01 40 00 "Quality Requirements."

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 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. Maintenance Data: Comply with requirements specified in Division 1 Section 01 92 00 "Operation and Maintenance Data."

Y. 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.

Z. Quantity Take-offs: Submit quantity take-offs for all indicated materials. Include area and quantity of all materials for coordination of product procurement with Owner. See Section 01 64 00.

AA. Procurement Submittals:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment and delivery schedule.
2. Submit inventory of materials within 5 days of receipt.
3. If material is to be stored off-site, include address, proof of lease, proof of insurance and photographs of stored material.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Subcontractor 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 the Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and 3 paper copies of certificate,

signed and sealed by the responsible design professional, for each product and system specifically assigned to Subcontractor 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.

PART 3 EXECUTION

3.01 SUBCONTRACTOR'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 the Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section 01 77 00 "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 Subcontractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT’S ACTION

A. General: The Architect will not review submittals that do not bear General Contractor’s and Subcontractor's approval stamp and will return them without action.

B. Action Submittals: The Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. The Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: The Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. The Architect will forward each submittal to appropriate party.

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

ATTACHMENTS

4.01 SAMPLE SUBMITTAL LOG

A. See attached for sample Submittal Log.

B. Contractor is responsible for preparing a Submittal Log to be used during the process of Construction.

1. Provide Submittal log to Architect prior to submittals.
2. Submittal Log is to include estimated dates of submittal and required review dates of submittals.

END OF SECTION

Section #	Section Name	Shop Drawings	Signed & Sealed	Samples for Verification	Samples for color selection	Manufactuer's Installation Instructions	Product Data	Mix Design	Calculations	Qualification Data	Test Data/Reports	Research / Evaluation Reports	Certificates	QA/QC Submittals	Operations & Maintenance	Warranty	Quantity Take-offs	Procurement	Other (See Notes)	Notes	ARCH	ID	CODE SPEC.	STRUCT	MECH	ELEC	AQ	CIV	LA ARCH	LT OPS	LT OPS (Cx)	LT IT/AV
03 - CONCRETE																															
03 20 00	Concrete Reinforcement	Yes																Yes						x								
03 30 00	Cast-In-Place Concrete	Yes						Yes			Yes			Yes				Yes	Yes	Certification of Compliance Proprietary Material & Items Material & Equipment	x			x x x								
03 45 00	Precast Architectural Concrete	Yes		Yes		Yes		Yes										Yes			x			x								
04 - MASONRY																															
04 20 00	Unit Masonry			Yes			Yes	Yes					Yes					Yes			x			x								
05 - METALS																															
05 12 00	Structural Steel	Yes	Yes				Yes		Yes	Yes	Yes		Yes					Yes	Yes	Welding Certificates	x			x	x							
05 21 00	Steel Joist Framing	Yes	Yes				Yes		Yes	Yes		Yes	Yes	Yes				Yes	Yes	Welding Certificates	x			x								
05 31 00	Steel Decking	Yes					Yes				Yes	Yes	Yes	Yes				Yes	Yes	Welding Certificates	x			x	x							
05 40 00	Cold-Formed Metal Framing	Yes	Yes				Yes		Yes	Yes	Yes	Yes						Yes	Yes	Welding Certificates	x			x								
05 50 00	Metal Fabrications	Yes		Yes						Yes			Yes					Yes	Yes	Welding Certificates	x			x								
05 51 00	Metal Stairs	Yes	Yes				Yes		Yes									Yes			x			x								
05 70 00	Decorative Metal	Yes					Yes											Yes			x	x										
05 73 13	Glazed Decorative Metal Railings	Yes		Yes			Yes				Yes							Yes			x	x										
06 - WOODS AND PLASTICS																															
06 10 00	Rough Carpentry						Yes					Yes						Yes			x											
06 20 00	Finish Carpentry			Yes			Yes					Yes				Yes		Yes			x	x										
06 40 00	Architectural Woodwork	Yes		Yes			Yes						Yes					Yes			x	x										
06 64 00	Plastic Paneling			Yes			Yes											Yes			x	x										
07 - THERMAL AND MOISTURE PROTECTION																															
07 13 26	Pre-Applied Sheet Membrane Waterproofing	Yes		Yes		Yes	Yes									Yes		Yes	Yes	Repair Details	x											
07 14 50	Fluid-Applied Waterproofing Membrane			Yes			Yes				Yes					Yes		Yes	Yes	Site Visit Report	x											
07 18 00	Traffic Coatings					Yes	Yes			Yes					Yes	Yes		Yes			x											
07 21 00	Thermal Insulation			Yes		Yes	Yes											Yes			x											
07 24 19	Water-Drainage Exterior Insulation and Finish System	Yes		Yes			Yes				Yes	Yes	Yes	Yes	Yes			Yes			x											
07 27 01	High Performance Vapor Retarder			Yes		Yes	Yes			Yes								Yes	Yes	Storage	x											
07 27 26	Fluid-Applied Membrane Air Barriers	Yes					Yes											Yes			x											
07 42 00	Metal Wall Panels	Yes		Yes			Yes							Yes				Yes	Yes	Coordination Drawings	x											
07 54 23	Thermoplastic polyolefin (TPO) Roofing	Yes		Yes		Yes	Yes						Yes			Yes		Yes	Yes	Pre-Installation Meeting Minutes Material & Equipment	x x											
07 62 00	Sheet Metal Flashing and Trim	Yes			Yes											Yes		Yes		Samples for Color Selection	x											
07 72 33	Roof Hatches	Yes					Yes											Yes			x											
07 81 00	Applied Fireproofing	Yes					Yes			Yes	Yes	Yes	Yes					Yes			x											
07 84 00	Firestopping						Yes			Yes	Yes		Yes					Yes	Yes	Product Schedule	x											
07 92 00	Joint Sealants				Yes		Yes			Yes	Yes		Yes			Yes		Yes	Yes	Color selection Joint Sealant Schedule	x x	x				x						
07 95 00	Preformed Traffic Durable Sealant Systems	Yes		Yes	Yes		Yes						Yes					Yes		Color selection	x	x		x								
08 - OPENINGS																															
08 11 13	Hollow Metal Doors and Frames	Yes					Yes											Yes			x	x										
08 14 16	Flush Wood Doors	Yes		Yes			Yes									Yes		Yes			x	x										
08 31 13	Access Doors and Frames	Yes					Yes											Yes	Yes	Access Door & Frame Schedule	x	x										
08 33 23	Overhead Coiling Doors	Yes		Yes			Yes								Yes			Yes			x	x										
08 38 00	Traffic Doors	Yes		Yes		Yes	Yes											Yes			x	x										
08 41 13	Aluminum Framed Entrances and Storefronts	Yes		Yes	Yes		Yes			Yes	Yes				Yes	Yes		Yes	Yes	Entrance Door Hardware Schedule. Sealant Color Selection	x	x										
08 44 13	Glazed Aluminum Curtainwalls	Yes		Yes		Yes	Yes		Yes							Yes					x	x										
08 71 00	Door Hardware	Yes		Yes			Yes			Yes	Yes		Yes		Yes	Yes		Yes	Yes	Keying Schedule Door Hardware Sets	x x	x	x							x x		
08 81 00	Glazing			Yes			Yes						Yes			Yes		Yes			x	x										
08 87 13	Solar Control Film	Yes		Yes		Yes	Yes				Yes					Yes		Yes			x											
09 - FINISHES																															
09 21 16	Gypsum Board Assemblies	Yes					Yes			Yes								Yes			x											
09 21 17	Gypsum Board Shaft Wall Assemblies						Yes											Yes			x											
09 30 00	Tiling			Yes			Yes										Yes	Yes			x	x										
09 51 13	Acoustical Panel Ceilings			Yes			Yes					Yes			Yes		Yes	Yes			x	x										
09 54 23	Linear Metal Ceilings			Yes			Yes					Yes			Yes		Yes	Yes			x	x										
09 62 38	Tile Wet Area Surfacing System	Yes		Yes		Yes	Yes						Yes		Yes	Yes		Yes			x	x						x				
09 64 00	Wood Flooring			Yes			Yes								Yes			Yes			x	x										
09 64 66	Wood Athletic Flooring			Yes			Yes											Yes			x	x										
09 65 19	Resilient Flooring			Yes	Yes		Yes								Yes		Yes	Yes		Transition and Nosing color selections.	x	x										
09 67 23	Resinous Flooring			Yes			Yes						Yes		Yes			Yes	Yes	Project Schedule	x	x										
09 68 13	Tile Carpeting			Yes			Yes			Yes	Yes					Yes	Yes	Yes	Yes	Project Schedule	x	x										
09 72 00	Wall Covering			Yes			Yes				Yes				Yes		Yes	Yes			x	x										
09 75 00	Interior Stone	Yes		Yes			Yes				Yes				Yes		Yes	Yes			x	x										
09 77 50	Vertical Surfacing Panel System			Yes		Yes	Yes								Yes		Yes	Yes	Yes	MSDS	x	x										
09 84 30	Sound Absorbing Wall and Ceiling Units	Yes		Yes	Yes		Yes			Yes								Yes	Yes	Fabric, color, pattern selection. Extra panels	x	x										
09 91 00	Painting			Yes			Yes											Yes	Yes	Product List	x	x										
10 - SPECIALTIES																															
10 14 00	Signage	Yes		Yes			Yes											Yes	Yes	Signage Schedule Wiring Diagrams	x x	x	x									
10 21 13.16	Plastic-Laminate-Clad Toilet Compartments	Yes					Yes									Yes		Yes	Yes	Product Specification Sheet	x	x										
10 22 36	Coiled Wire Fabric Attachment Systems	Yes		Yes			Yes		Yes				Yes					Yes			x	x										
10 28 13	Toilet and Bath Accessories						Yes											Yes	Yes	Project Schedule	x	x										
10 28 19	Glass Shower Doors	Yes		Yes			Yes								Yes						x	x										
10 44 00	Fire Protection Specialties	Yes		Yes			Yes								Yes			Yes			x											
11 - EQUIPMENT																															
11 21 73	Commercial Laundry Equipment						Yes											Yes			x				x	x			x			
11 40 00	Food Service Equipment	Yes					Yes				Yes				Yes			Yes	Yes	Wiring Diagrams Project Record Documents	x x				x	x						
11 66 00	Athletic Equipment	Yes					Yes								Yes			Yes			x	x										
12 - FURNISHINGS																															
12 36 00	Solid Surfacing Countertops and Sills	Yes		Yes		Yes	Yes			Yes			Yes		Yes			Yes														
12 56 90	Spa Furniture			Yes			Yes								Yes			Yes			x	x			x	x						
12 92 00	Artificial Plants	Yes		Yes		Yes	Yes								Yes			Yes														
13 - SPECIAL CONSTRUCTION																															
13 11 13	Swimming Pools - General	Yes	Yes					Yes			Yes				Yes	Yes		Yes	Yes	Record Drawings Owner Training Video	x			x			x					
13 11 15	Swimming Pool Finishes			Yes		Yes	Yes						Yes			Yes		Yes			x	x					x					
13 11 16	Swimming Pool Piping & Valves						Yes											Yes							x		x					
13 11 30	Prefabricated Swimming Pools	Yes		Yes						Yes						Yes		Yes			x			x			x					
13 24 16	Saunas	Yes		Yes			Yes								Yes	Yes		Yes			x	x										
13 24 16.24	Prefabricated Exterior Saunas	Yes	Yes	Yes			Yes		Yes				Yes			Yes		Yes			x	x										
14 - CONVEYING EQUIPMENT																															
14 21 50	MRL Electric Traction Passenger Elevators	Yes		Yes			Yes			Yes			Yes		Yes	Yes		Yes	Yes	Continuing Maintenance Proposal	x	x									x	
21 - FIRE SUPRESSION- SEE DIV 21 SECTIONS																															
22 - PLUMBING - SEE DIV 22 SECTIONS																															
23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC) - SEE DIV 23 SECTIONS																															
25 - INTEGRATED AUTOMATION - SEE DIV 25 SECTIONS																															
26 - ELECTRICAL - SEE DIV 26 SECTIONS																															
27 - COMMUNICATIONS - SEE DIV 27 SECTIONS																															
28 - ELECTRONIC SAFETY AND SECURITY - SEE DIV 28 SECTIONS																															
31 - EARTHWORK																															
31 10 00	Site Clearing																		Yes	Existing Conditions Record Drawings								x x				
31 23 00	Excavation and Fill						Yes			Yes	Yes		Yes						Yes	Preexcavation Photos or Videos Delivery Slips								x x				
31 23 19	Dewatering	Yes								Yes				Yes					Yes	Photographs								x				
32 - EXTERIOR IMPROVEMENTS																															
32 13 13	Concrete Paving	Yes					Yes	Yes		Yes			Yes					Yes			x											

Section #	Section Name	Shop Drawings	Signed & Sealed	Samples for Verification	Samples for color selection	Manufactuer's Installation Instructions	Product Data	Mix Design	Calculations	Qualification Data	Test Data/Reports	Research / Evaluation Reports	Certificates	QA/QC Submittals	Operations & Maintenance	Warranty	Quantity Take-offs	Procurement	Other (See Notes)	Notes	ARCH	ID	CODE SPEC.	STRUCT	MECH	ELEC	AQ	CIV	LA ARCH	LT OPS	LT OPS (Cx)	LT IT/AV
32 14 00	Unit Paving			Yes			Yes											Yes	Yes	Sieve Analyses	x	x							x			
32 17 23	Pavement Marking						Yes											Yes			x											
32 18 23	Synthetic Field Sport Surfacing			Yes			Yes							Yes		Yes		Yes			x	x										
32 18 25	Athletic Surfacing	Yes		Yes			Yes							Yes				Yes			x	x										
32 31 19	Decorative Metal Fences and Gates	Yes		Yes			Yes								Yes			Yes	Yes	Delegated Design Submittal	x										
32 33 00	Site Furnishings	Yes		Yes			Yes									Yes		Yes			x								x			
32 35 00	Screening Devices	Yes					Yes											Yes			x											
32 35 15	Landscape Shade Tops						Yes				Yes		Yes		Yes	Yes		Yes			x											
32 35 16	Outdoor Shade Structures	Yes	Yes	Yes			Yes								Yes	Yes		Yes			x											
32 84 00	Planting Irrigation	Yes					Yes			Yes					Yes			Yes	Yes	Wiring Diagrams	x							x	x			
																				Delegated Design Submittal	x							x	x			
																				Coordination Drawings	x							x	x			
																				Zoning Chart	x							x	x			
																				Controller Timing Schedule	x							x	x			
																				Field Quality Control Reports	x							x	x			
32 92 00	Turf and Grasses						Yes			Yes	Yes							Yes	Yes	Certification of Grass Seed								x	x			
																		Yes		Certification of Seed Mixtures								x	x			
32 93 00	Plants						Yes			Yes	Yes		Yes			Yes		Yes	Yes	Maintenance Instructions	x							x	x			
33 - UTILITIES																																
33 10 00	Water Utilities	Yes					Yes							Yes		Yes			Yes	Coordination Drawings												
33 30 00	Sanitary Sewerage Utilities	Yes											Yes	Yes											x				x			
33 40 00	Storm Drainage Utilities	Yes					Yes						Yes	Yes					Yes	Coordination Drawings					x			x				
																				Profile Drawings					x			x				
41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT																																
41 22 00	Hoists and Cranes	Yes					Yes	Yes		Yes			Yes					Yes			x			x								

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 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 General Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit General Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for General Contractor to provide quality-assurance and quality-control services required by the Owner or authorities having jurisdiction are not limited by provisions of this Section.

1.02 RELATED SECTIONS

A. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.03 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 Life Time.

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. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Laboratory Mockups: Full-size, physical assemblies constructed at testing facility to verify performance characteristics.

D. Preconstruction Testing: Tests and inspections performed specifically for the 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, an NVLAP, 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, i.e., 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: General Contractor or another entity engaged by General Contractor as an employee, or 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 or trades.

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project, with at least one of these being within the past 5 years; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 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 that are different, but apparently equal, to Owner's Representative 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 Owner's Representative for a decision before proceeding.

1.05 INFORMATIONAL SUBMITTALS

A. General Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.
   1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the General Contractor.
   2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the General Contractor.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.06 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 re-inspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.

3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. 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.

1.07 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements. All parties must satisfy the most stringent qualifications specified for the work.

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. Work shall have occurred within five (5) years.

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 are similar to those indicated for this Project in material, design, and extent.

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 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. 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. General 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. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    d. When testing is complete, remove test specimens, assemblies, 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 and Owner's Representative, with copy to General Contractor and Subcontractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by the Architect or Owner's Representative.
   2. Notify Owner's Representative 7 days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow 7 days for initial review and each re-review of each mockup.
   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.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections in Divisions 2 through 33.

1.08 QUALITY CONTROL

A. Owner's 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 General 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 re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to General Contractor, and the Contract Sum will be adjusted by Change Order.

B. General Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are General Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Where services are indicated as contractor's/subcontractor'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 general Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. 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 manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Subcontractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Owner and General Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Owner and General Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Subcontractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Subcontractor.

F. 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.

G. 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.

1.09 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: The Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of the Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Owner and General Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to the Owner, with copy to Subcontractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Re-testing and re-inspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 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 with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 1 Section 01 77 00 "Closeout Procedures."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Subcontractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 43 39
MOCKUPS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes information on the construction of the required Mockups for Quality Assurance:
   1. First in place Mockups consist of the first complete installation in the course of construction for approval by Architect. See individual Specification Sections for size and other requirements. The following materials shall be mocked up in this manner:
      a. Intumescent fireproofing.
      b. Sealant Mockup In-place, consisting of sealant color tests for transitions.
      c. Aluminum framed entrances and storefronts.
      d. Tile and waterproofing.

1.02 RELATED SECTIONS

A. All work must conform to the requirements of the following Sections:
   1. Section 01 31 00 - Project Management and Coordination.
   2. Section 01 33 00 - Submittal Procedures.
   3. Section 01 40 00 - Quality Requirements.
   4. Section 01 60 00 - Product Requirements.

B. The following Sections require Mockups in place:
   1. Section 07 81 60 - Intumescent Fireproofing.
   2. Section 07 92 00 - Joint Sealants.
   3. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.
   4. Section 08 81 00 - Glazing.
   5. Section 09 30 00 - Tiling.

1.03 REFERENCE STANDARDS

A. All work must conform to the standards specified in its Section.

1.04 SUBMITTALS

A. Submit Product Information and Shop Drawings as required by the relevant Section prior to construction of Mockup.
   1. All work in the Mockup must have been previously approved by the submittal process as specified in Section 01 33 00.

1.05 QUALITY ASSURANCE

A. All work in the Mockup must conform to the Quality Assurance standards specified in its Section and Section 01 40 00.

B. Contractor is responsible for maintaining Mockup's structural integrity and necessary access.

C. Coordinate the work of all subcontractors to complete the work in a timely manner such that the Mockup can perform its function in the review process.
   1. Notify Architect in advance of completion to schedule review.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide Materials as shown on Drawings and specified in the appropriate Section.

PART 3 EXECUTION

3.01 PREPARATION

A. All Subcontractors are to prepare for their work in the manner specified in the appropriate Section.
   1. Coordinate all work to occur as it would in the building Construction.

3.02 INSTALLATION

A. General:
   1. All Subcontractors are to install their work in the manner specified in the appropriate Section.
      a. Coordinate all work to occur as it would in the building Construction.
      b. Underlying work is to remain exposed to view such that the work of all trades can be seen.
         1) Coordinate locations of exposed underlying work with Architect and other trades.

B. First in place Mockups:
   1. Fabricate Mockups as directed by its specification section.
   2. Mockups that are defined as In place Mockups are to be constructed within the building and may remain as part of the completed Work.
      a. Complete First in place mockups first before proceeding to surrounding work.

3.03 INSPECTION AND APPROVAL

A. Contractor to notify Architect of Mockup completion to schedule inspection and approval.

B. Mock ups are to be inspected by representatives of manufacturers providing warranties to certify that the Work complies with the requirements of the warranty(ies).
   1. Representatives may require applicable tests to be performed on Mockup. See individual product section for testing requirements.

C. Work that is not approved shall be amended and reinspected for approval.
   1. Work may not proceed until Mockup is approved by Architect and manufacturer's warranty representatives.

3.04 SEALANT MOCKUP IN PLACE

A. Coordinate installation of Mockup In-place with Architect.

B. Each color of sealant to be included is to be 3'-0" min length.

C. Do not proceed with Sealant work until colors are approved.

3.05 POST APPROVAL

A. Approved Mockups In-place may be incorporated into the Building.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Requirements for Special Inspections, Material Testing and Structural Observations.
   1. See Structural Drawings for more information on structural testing requirements.
   2. See Below for Structural Schedules.

B. Requirements for Steel Components, including:
   1. Structural Steel.
   2. Steel Roof and Floor Decks.
   3. Cold Formed Steel Construction.

C. Requirements for Concrete Construction.

D. Requirements for Masonry Construction.

E. Requirements for Soils.

F. Requirements for Foundations:

G. Requirements for Sprayed Fire-Resistant Materials.

H. Requirements for Exterior Insulation and Finish Systems. (EIFS)

I. Requirements for Fire Resistant Penetrations and Joints.

J. Requirements for Smoke Control.

K. Requirements for Architectural Components, including:
   1. Erection and fastening of exterior cladding and interior and exterior veneers.
   2. Erection and fastening of interior and exterior non-bearing walls.
   3. Seismic Requirements for Architectural Components.

L. Requirements for Fabricators.

M. Requirements for Miscellaneous Areas, including:
   1. Suspended Acoustical Ceilings.
   2. Soil Backfill.
   3. Soils for curb and gutter.
   4. Soils for parking lots.
   5. Soils for utility trench backfill.
   6. Reinforcement for slab on grade sidewalks and drive approaches.
   7. Reinforcement for interior slab on grade.
   8. Concrete testing for slab on grade sidewalks and drive approaches.
   9. Concrete testing for interior slab on grade.
   10. Asphalt inspection.
   11. Asphalt testing.
   12. Steam and water line welding.
   13. Seismic supports for duct work and sealing of joints for duct work.
   14. Seismic supports for electrical raceways, cable trays and lights.
   15. Seismic supports for plumbing lines including gas, water, steam and condensation.
   16. Seismic bracing for mechanical units both on slab and suspended.
   17. Special Cases.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 01 40 00 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

C. Section 01 45 34 - Special Inspections Acknowledgements Form.
D. Section 03 20 00 - Concrete Reinforcement.
E. Section 03 30 00 - Cast-in-Place Concrete.
F. Section 04 20 00 - Unit Masonry Assemblies
G. Section 05 12 00 - Structural Steel Framing.
H. Section 05 21 00 - Steel Joist Framing.
I. Section 05 31 00 - Steel Decking.
J. Section 05 40 00 - Cold-Formed Metal Framing.
K. Section 05 50 00 - Metal Fabrications.
L. Section 05 51 00 - Metal Stairs.
M. Section 07 24 19 - Water-Drainage Exterior Insulation and Finish System. (EIFS)
N. Section 07 81 00 - Applied Fireproofing.
O. Section 07 84 00 - Firestopping.
P. Section 09 21 16 - Gypsum Board Assemblies.
Q. Section 09 51 13 - Acoustic Panel Ceilings.
R. Section 22 01 00 - General Provisions for Plumbing.
S. Section 22 05 29 - Hangers and Supports for Plumbing.
T. Section 22 11 25 - Facility Natural-Gas Piping.
U. Section 22 13 16 - Sanitary Waste and Vent Piping.
V. Section 22 13 19 - Sanitary Waste Piping Specialties.
W. Section 22 52 13 - Steam Room Generators.
X. Section 23 01 00 - General Provisions for HVAC.
Y. Section 23 05 29 - Hangers and Supports for HVAC.
Z. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
AA. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

B. Code or Building Code: ICC (IBC), International Building Code, Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements and specifically, Chapter 17 - Special Inspections and Tests.

C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.

1.04 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code (Current edition)
B. ACI 318 - Building Code Requirements for Structural Concrete 2014, with Errata.
C. ACI 530 - Specification for Masonry Structures 2016.
D. AISC 341 - Seismic Provisions for Structural Steel Buildings 2016.
E. AISC 360 - Specification for Structural Steel Buildings 2010.
F. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures 2016.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2012a, with Editorial Revision.

H. ASTM C476 - Standard Specification for Grout for Masonry 2010.

I. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry 2016.

J. ASTM C1611 - Standard Test Method for Slump Flow of Self-Consolidating Concrete 2014.

K. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 2019.

L. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019.

M. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

N. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.

O. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage 2007, with Editorial Revision (2014).

P. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide 2014.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015.

R. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars 2011.

S. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

T. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291 2019.

U. ICC (IBC)-2018 - International Building Code 2018.

V. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck 2017.

W. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Owner shall retain one or more qualified agencies to perform Special Inspections.
   1. Special Inspection Agency may retain a separate qualified agency to perform laboratory testing.

B. Special Inspection Agency Qualifications:
   1. Independent firm specializing in performing testing and inspections of the type specified in this section.
   2. Accredited by IAS according to IAS AC291.
   3. Approved by AHJ prior to performing any duties.

C. Inspection Reports:
   1. Reports shall meet requirements of IBC 1704.2.4, AHJ.
   2. Inspection reports are to be submitted to Owner, Construction, Project Manager, and AHJ within 48 hours of performing inspections.
   3. Final inspection report shall be submitted following completion of the project documenting all special inspections performed and a statement indicating that the structure is in compliance with the approved construction documents and applicable codes.

1.06 SUBMITTALS

A. See Section 01 33 00 Submittal Requirements.

B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Submit certification that Special Inspection Agency is acceptable to AHJ.
4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.

C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Submit certification that Testing Agency is acceptable to AHJ.
4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.

D. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
1. Include:
a. Date issued.
b. Project title and number.
c. Name of Special Inspector.
d. Date and time of special inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of special inspection.
h. Date of special inspection.
i. Results of special inspection.
j. Compliance with Contract Documents.
2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

E. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

F. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

G. Fabricator's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS AND SCHEDULE OF SPECIAL INSPECTIONS AND TESTING

A. Perform work as required by AHJ, according to Code and as directed by the construction documents.

B. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic, as defined below.

1. Continuous Special Inspection: (Cont) Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: (Per) Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work. Coordinated period with designer and AHJ.
3. Quality Control (QC) refers to items provided by installer, fabricator, erector, or other responsible contractor as applicable. See AISC 360-16 and 341-16.
4. Quality Assurance (QA) shall be provided by parties other than those provding QC when required by the authority having jurisdiction (AHJ), applicable building code (ABC), purchaser, owner or engineer of record (EOR). Nondestructive testing (NDT) shall be performed by the agency or firm responsible for Quality Assurance, except as permitted in accordance with AISC 341, Section N6. See AISC 360-16.
5. Random daily Basis: (O) Inspection occurs during work on a random daily basis. See AISC 360-16.
6. On completion: (P) Inspection to occur prior to acceptance of item. See AISC 360-16.
7. Documentation: (D) Inspector to prepare reports that work was performed per the Contract Documents.
8. Other: (P/O) Perform or Observe.
9. If none of the above is specified, inspection is to be performed once at the time indicated.

C. See AISC 360-16 for definitions of Documents and Tasks.

D. All inspections must be documented as specified.

E. Refer to drawings and individual specification sections for more information.

3.02 REQUIREMENTS FOR SPECIAL INSPECTIONS OF STRUCTURAL STEEL

A. See IBC 1705.2.1, Structural drawings and specifications.

B. If applicable, see also special inspections and testing for seismic resistance.

3.03 STEEL ROOF AND FLOOR DECKS (IBC 1705.2.2; SECTION 6.1 AND APPENDIX 1 OF SDI QA/QC - 2017)

A. **See IBC 1705.2.2, SDI QA/QC - 2017, Section 6.1 and Appendix 1, and Structural drawings and specifications.**

3.04 COLD-FORMED STEEL CONSTRUCTION (OWNER-REQUIRED, IBC 1705.12.2 AND 1705.13.3)

A. **See IBC 1705.12.2 and 1705.13.3, Structural drawings, specifications, certified shop drawings. Some special inspections below are driven by owner preferences and are not part of the building code.**

3.05 CONCRETE CONSTRUCTION

A. **See IBC 1705.3, IBC Chapter 19, AWS D1.4, ACI 318-14, Structural Drawings and Specifications**

3.06 MASONRY CONSTRUCTION

A. See IBC 1705.4, Drawings and Specifications.

3.07 SOILS CONSTRUCTION

A. **See IBC 1705.6, Structural, Civil drawings and specifications.**

3.08 SPRAYED FIRE-RESISTANT MATERIALS

A. **See IBC 1705.14, Architectural drawings and specifications.**

Items	Freq	Instructions
Surface preparation	Per	Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer's instructions.

Application	Per	Substrate shall have min ambient temperature and ventilation before and after application per approved manufacturer instructions.
Material thickness	Per	Samples shall be taken from selected floor, roof and wall assemblies and structural members. No more than 10% of the samples shall be less than the thickness required by the fire-resistance design.
Material density	Per	Density tests shall be performed in accordance with ASTM E 605 for every 2,500 sqft of floor, roof or wall area. One sample must also be provided for each beam, girder, truss or column at each story.
Bonding Strength	Per	Bond strength tests shall be performed in accordance with ASTM E 736 for every 2,500 sqft of floor, roof or wall area. One sample must also be provided for each beam, girder, truss or column at each story. The bond strength shall not be less than 150psf.

3.09 EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

A. **See IBC 1705.17, Architectural drawings and specifications.**

Items	Freq	Instructions
Material and installation	Per	Verify that water-resistive barrier, complying with ASTM E 2570, is installed appropriately over a sheathing substrate.

3.10 FIRE-RESISTANT PENETRATIONS AND JOINTS

A. **See IBC 1705.17, Architectural drawings and specifications.**

Items	Freq	Instructions
Penetration firestops	Per	Listed systems shall be inspected in accordance with ASTM E 2174.
Fire-resistant joint systems	Per	Listed systems shall be inspected in accordance with ASTM E 2393.

3.11 SMOKE CONTROL

A. **See IBC 1705.18, Mechanical drawings and specifications.**

Items	Freq	Instructions
Verify device locations and perform leakage testing	Per	During erection of ductwork and prior to concealment.
Pressure difference testing, flow measurements and detection control verification	Per	Prior to occupancy and after sufficient completion.

3.12 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE: ARCHITECTURAL COMPONENTS

A. **See IBC 1705.12.5, Architectural drawings and specifications.**

Special Inspections for seismic resistance: For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F		
Items	Freq	Instructions
Erection and fastening of exterior cladding	Per	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Applies for components 30 feet or more above grade and weighing more than 5 psf.
Erection and fastening of exterior nonbearing walls	Per	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Applies for components 30 feet or more above grade.
Erection and fastening of interior nonbearing walls	Per	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Applies for components 30 feet or more above grade and weighing more than 15 psf.
Erection and fastening of interior and exterior veneers	Per	Verify that anchorage complies with approved construction documents. Applies for components 30 feet or more above grade and weighing more than 5 psf. Inspection of post-installed anchors shall comply with approved ICC-ES report.

3.13 FABRICATORS

A. **See IBC 1704.2.5 & 1705.10, drawings and specifications of relevant discipline.**

Items	Freq	Instructions
By product listed above, designer/discipline, or AHJ	By designer or AHJ	Perform according to designer's or AHJ's requirements

3.14 MISCELLANEOUS AREAS

A. **See drawings and specifications of the appropriate discipline.**

Items	Freq	Instructions
By designer/discipline or AHJ.	By designer or AHJ	Perform according to designer's or AHJ's requirements.

END OF SECTION

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ACKNOWLEDGEMENTS

(Each appropriate representative shall sign below)

Owner:		Firm:		Date:	
Contractor:		Firm:		Date:	
Architect:		Firm:	LT Architecture, LLC	Date:	
SER:		Firm:	VAA, LLC	Date:	02/09/26
SI-S:		Firm:		Date:	
SI-T:		Firm:		Date:	
ITA		Firm:		Date:	
ITA:		Firm:		Date:	
F:		Firm:		Date:	
F:		Firm:		Date:	

Legend: SER – Structural Engineer of Record SI-T – Special Inspector - Technical F – Fabricator SI-S – Special Inspector - Structural ITA – Independent Testing Agency

ACCEPTED FOR THE BUILDING DEPARTMENT BY _____DATE:_____

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 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.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures for requests for substitutions.

B. Section 01 40 00 - Quality Requirements for testing requirements of products.

C. Divisions 2-33 - All products in all sections must comply with the standards specified herein.

1.03 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

1.04 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product, fabrication, or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify General Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Division 1 Section 01 33 00 "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section 00 33 00 "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Subcontractor 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.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Products are to be procured no later than 30 days after return of approved submittals.

1. Submit receipts and delivery schedule for all products.

B. 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.
   1. Submit inventory of products to Owner within 5 days of receipt.

C. Delivery and Handling:
   1. Coordinate all material receiving, handling, trucking, and storage per site-specific conditions.
      a. Review site logistics at time of bid to determine material storage requirements of each subcontractor.
   2. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   3. 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.
   4. 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.
   5. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

D. Storage, general:
   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. Store foam plastic and other vulnerable products away 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.

E. Off-Site Storage:
   1. Materials procured for Life Time and stored off of the project site must comply with the following requirements:
      a. Materials must be clearly labeled and wrapped.
         1) Materials procured for Life Time may NOT be used on other projects.
      b. Materials must be insured against loss or damage.
      c. Storage facility must be available for inspection by Life Time personnel or representatives.
      d. Submit inventory of materials delivered within 5 days of delivery.

1.07 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 Subcontractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. Refer to Divisions 2 through 33. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Installer's warranty.
   1. Provide standard 1 year Installer's Warranty for all products.

D. Submittal Time: Comply with requirements in Division 1 Section 01 77 00 "Closeout Procedures."

PART 2 PRODUCTS

2.01 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. Architect and Owner reserve 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 the selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

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 Subcontractor'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 Subcontractor's convenience will not be considered.
   3. Products:
      a. Restricted List: 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 Subcontractor's convenience will be considered.
      b. Non-restricted List: 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: 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 Subcontractor's convenience will be considered.
      b. Non-restricted List: 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: 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.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Owner Representative’s sample. Owner Representative’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, submit a Substitution Request Form per Section 00 43 25 for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by the Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. The Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

A. Conditions for Consideration: The Architect will consider Subcontractor's request for product substitution when the following conditions are satisfied. If the following conditions are not satisfied, the 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, that it 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 (NOT USED)

END OF SECTION

SECTION 01 64 00
OWNER-FURNISHED PRODUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for Coordination and Installation of Owner Furnished Products.
   1. See Supplementary bidding materials for ennumeration of Owner Furnished Products.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 77 00 - Closeout Procedures: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate delivery, storage and installation of all Owner Furnished materials indicated to be installed by Contractor.

B. Coordinate construction activities with Owner Furnished materials indicated to be installed by Owner, such that other construction activities do not interfere with the installation of these materials.

C. Coordinate installation of all items in this section with all impacted trades.

D. Coordinate installation of Owner-installed and Vendor-installed products with Owner and Vendor.

1.05 SUBMITTALS

A. Show Owner furnished items on shop drawings when they impact the work of other Sections.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of Owner furnished products with Owner or Vendor.

B. Store Owner-furnished products according to manufacturer's recommendations.
   1. See Section 01 60 00 for requirements of off-site storage of materials.

C. General Contractor to receive, unload, distribute and install Owner-furnished products indicated to be installed by Contractor unless otherwise directed, in writing, from Owner’s Representative.

1.08 FIELD CONDITIONS

A. Do not install Owner-furnished products when field conditions do not meet manufacturer's requirements.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. See Supplementary Bidding Materials.

PART 3 EXECUTION

3.01 INSTALLERS

A. All Owner-furnished Products to be installed by workers skilled in the appropriate trades.

3.02 EXAMINATION

A. Verification of Conditions: Verify that conditions at installation location are suitable for installation.
   1. Verify that electrical, plumbing, data or utility hookups are present and compatible, if applicable.

B. If conditions are not acceptable, notify Architect.

3.03 PREPARATION

A. Protection of In-Place Conditions: Protect all adjacent materials and finishes.

3.04 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.05 REPAIR

A. Repair any damage to surrounding materials and finishes that may have occurred during installation.

3.06 SYSTEM STARTUP

A. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

B. Verify that all Owner-furnished items function as required after installation.

3.07 CLEANING

A. Clean Owner-furnished product and surrounding finishes as required.

3.08 PROTECTION

A. Protect installed Owner-furnished product from subsequent construction operations.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 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.

1.02 RELATED SECTIONS:

A. Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

B. Section 00 52 00 - Agreement Forms

C. Section 00 72 00 - General Conditions

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner’s Representative of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, As-Built Drawings, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information. See Section 01 78 39.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner’s Representative. Advise Owner’s Representative personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements only after successful completion of Functional Testing. See Section 01 91 13.
   11. Advise Owner’s Representative of changeover in heat and other utilities.
   12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   13. Complete final cleaning requirements, including touchup painting.
   14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify the General Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify the General Contractor of items, either on the General Contractor's list or additional items identified by the Architect or Owner, 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.
   2. Results of completed inspection will form the basis of requirements for final completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Division 0 Section 00 52 00 "Agreement Forms" and Division 0 Section 00 72 00 “General Conditions.”
   2. Submit certified copy of Architect’s Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, the Architect will either proceed with inspection or notify General Contractor of unfulfilled requirements.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 WARRANTIES

A. Submittal Time: Submit written warranties on request of Owner’s Representative for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Submit warranties via Project Website (Procore)
   2. 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 table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.01 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.
   1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 EXECUTION

3.01 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. General Contractor to complete the following cleaning operations 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; shampoo 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. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections:
   1. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   2. Divisions 2 through 33 Sections for specific requirements for project record documents of the Work in those Sections.
   3. Section 00 40 00 Contract Packet Forms; Warranty and Standard Construction Subcontract.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Submit electronically, via Procore.
   2. Number of Copies: Submit 1 set of marked-up record prints.
   3. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal: Submit PDF electronic files of marked-up record prints. LTF Construction will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal: Submit PDF electronic files of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.

B. PDF electronic files Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
   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. Record data as soon as possible after obtaining it.
      c. Record and check the markup before enclosing concealed installations.
   2. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
   3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with LTF Construction. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

2. Format: DWG, operating in Microsoft Windows operating system.
3. Format: Annotated PDF electronic file with comment function enabled.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to LTF Construction for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Designation "PROJECT RECORD DRAWINGS."
c. Name of Subcontractor.

2.02 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 annotated PDF electronic file.

2.03 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 annotated PDF electronic file.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records 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 PDF electronic file.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the 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 LTF Construction reference during normal working hours.

END OF SECTION

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SECTION 01 84 21
INTERIOR CONCRETE FLOOR FINISHING PERFORMANCE REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Work of this Section includes requirements for developing content relating to construction of concrete slabs-on-grade and suspended slabs (concrete flatwork) for the Contractor's Quality Management Program (QMP) specified in Section 01 45 00 – Quality Control that documents the policies and organizational structure to achieve specified concrete finishing tolerances for concrete substrates associated with the following:

1. Concrete Mix Design: Prepare concrete mix design that accounts for appropriate workability (slump and flow) based on performance requirements for the Project, and that accounts for concrete trades' requirements to achieve specified concrete tolerances including adjustment for slump and consolidation on site, inclusion of shrinkage compensating admixtures and applied floorcovering manufacturers' requirements.
2. Concrete Formwork: Prepare formwork erection drawings for suspended slabs in accordance with CSA A23.1, Item 6.5.2 and verify that perimeter (FL) of horizontal concrete slabs and blocked-out openings through slabs are at the same level [; including service and crane block-outs in suspended slab construction, accounting for formwork camber]; and verify that construction schedule accounts for specified strength gain before removal and relocation.
3. Concrete Reinforcement: Schedule installation of concrete reinforcement to allow sufficient time for Construction Manager's review and acceptance before scheduling delivery of concrete to project site.
4. Concrete Delivery: Control delivery of concrete to maintain concrete mix design properties accepted by the Consultant at time of discharge, without use of unscheduled additives and water by the transit mix operator and onsite personnel.
5. Concrete Finishing: Coordinate with Section 03 30 for specified FF:FL tolerances and locations of different FF:FL outcomes (the footprint), that account for admixtures required to attain optimal concrete workability for placers and finishers, and that are compatible with adhesives used for applied finishes and floorcoverings.
6. Concrete Protection: Describe methods to protect newly placed and finished concrete from rain and snow, freezing conditions, wind, heat and differential shading until concrete is cured sufficiently to prevent damage to surface finish, and confirm methods to limit loads on new concrete slabs until sufficient strength is attained to support construction loads.
7. Concrete Curing: Describe methods for managing application and removal of Products used to aid the concrete curing process, with the goal to minimize the use of surface applied curing compounds, sealer/hardeners and moisture retarders that may be detrimental to surface adhesion for floorcoverings and underlayments.
8. Concrete Surface Preparation: Describe methods for managing removal of incompatible curing compounds and providing concrete surface profiles acceptable for bonding of floorcovering adhesives.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcement: Requirements for steel reinforcing bars for slabs-on-grade.

B. Section 03 30 00 - Cast in Place Concrete: Establish requirements for maximum surface density of placed concrete when using supplementary cementing materials [and shrinkage compensating admixtures] to achieve floorcovering manufacturer's requirements for effective adhesive bond.

C. Section 05 21 00 - Steel Joist Framing: Management of camber associated with composite concrete and steel decking required to minimize negative deflection and curvature of horizontal floor slabs between structural bays.

D. Section 05 31 00 - Steel Decking: Management of loading and spreading of concrete associated with composite concrete and steel decking to minimize deflection of steel decking between joists and achieve Concrete Quantitative Tolerance (FF:FL).

E. Section 07 18 00 - Traffic Coatings: Minimum Concrete Quantitative Tolerance (FF:FL) required for installation of resinous traffic toppings.

F. Section 09 05 61 - Common Work Results for Flooring Preparation: Preparation of concrete slab surfaces using cementitious repair and filling materials, moisture mitigation compounds and surface grinding required to achieve Floorcovering Qualitative Tolerances (Straightedge) ready for installation of floorcoverings.

G. Section 09 30 00 - Tiling: Minimum surface tolerances required for installation of tiling products.

H. Section 09 65 19 - Resilient Flooring: Minimum surface tolerances required for installation of resilient floorcoverings.

I. Section 09 67 23 - Resinous Flooring: Minimum surface tolerances required for installation of Resinous Flooring.

J. Section 22 13 19 - Sanitary Waste Piping Specialties: For coordination with floor drains.

1.03 DEFINTIONS

A. Floorcoverings: Surface finishes that are directly adhered to concrete substrates such as resilient flooring, carpeting, wood flooring, laminate flooring, and other similar flexible premanufactured finishes.

B. Applied Finishes: Surface finishes that are applied to concrete such as exposed architectural concrete finishing (polished, burnished or densified), tile flooring, masonry flooring, terrazzo flooring and similar rigid finish materials, supported wood flooring, fluid applied flooring, and other flooring treatments that are not otherwise defined as floorcoverings.

C. Concrete Surface Profile (CSP): Topographical contour, surface texture of exposed concrete surfaces or substrates as defined by the International Concrete Repair Institute (ICRI), and are required to establish acceptable mechanical bond between floorcoverings, applied finishes, mortar setting materials, fluid applied flooring, or cementitious coatings with individual material CSP requirements specified in RELATED REQUIREMENTS.

D. Concrete Finishing Tolerances: The relative flatness and levelness of horizontal concrete surfaces identified to receive floorcoverings or other applied finishes, and that have different measurement standards and tolerances based on the component of the work and time of installation:
   1. Concrete Quantitative Tolerance (FF:FL): Concrete flatness (FF) and levelness (FL), based on quantitative results using ASTM E1155 measurements and surface tolerances described in CSA A23.1, Table 21: and that are measured within 3 days of placement before to removal of concrete forms.
   2. Floorcovering Qualitative Tolerance (Straightedge): Concrete flatness based on qualitative evaluation of observed gap measured along a 3 m unlevelled straightedge placed randomly.

E. Concrete Floor Finishing Tolerances: Concrete finishing tolerances generally apply to entire slab areas; materials and methods associated with achieving tolerances vary based on when they are measured, and which Subcontractor is directed by the General Contractor to perform work to achieve the specified tolerance as follows:
   1. Conventional Tolerance Concrete Floor Finishing: Concrete slabs having finishing tolerances for concrete substrates ranging between FF 20:FL 15 and FF 35:FL 25 specified in Section 03 30 00.

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI):
   1. ACI 117.1R-14, Guide for Tolerance Compatibility in Concrete Construction

B. ASTM International (ASTM):
   1. ASTM E1155-20, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

2. ASTM F710-19e1, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

C. Canadian Standards Association (CSA):
1. CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

D. National Floor Covering Association of Canada (NFCA):
1. NFCA Floor Covering Reference Manual

1.05 ADMINISTRATIVE REQUIREMENTS

A. Contractor's Quality Management Program (QMP): Submit QMP indicating standardized approach to managing quality of materials and workmanship during execution of the work associated with achieving concrete finishing tolerances identified in the Specifications including the following:
1. Preconstruction Quality Planning: Develop preconstruction activities forming a part of the QMP in accordance with CSA A23.1, Article 7.1 and requirements of this Section.
2. Quality Assurance: Activities, actions, corrective remedies and procedures performed before and during execution of the Work by the Contractor to protect against defects and deficiencies, and confirming that construction is consistent with specified performance requirements listed within the Specification.
3. Quality Control: Observations, procedures, and related actions performed by the Contractor during and after execution of the Work to verify that completed construction complies with specified performance requirements, standards and technical requirements listed within the Specifications

B. Subcontractor Contribution: Subcontractors will coordinate requirements described in this section with the Contractor to identify installation conditions affecting concrete placing and finishing, and that affect compatibility of floorcoverings discussed during the pre-construction meetings described below, Contractor will incorporate comments as a part of the QMP.

C. Pre-Construction Tolerance Coordination Meetings: Conduct pre-construction tolerance coordination meetings in accordance with Section 01 31 00 – Project Management and Coordination, attended by Owner, Architect, Construction Manager, General Contractor and Subcontractors whose work is affected by work of this Section to discuss the following before starting any concrete related construction:
1. Calculated changes to floor flatness profiles arising from natural changes to concrete such as shrinkage, curling, creep or plastic deformation that will occur between performing measurements for Concrete Quantitative Tolerances and measurements for Floorcovering Qualitative Tolerances;
2. Methods for aligning measurement tolerances for individual trade contributions to the work, to those required by other parts of the work;
3. Confirming concrete density, absorption and surface profile required for installation of applied finishes and floorcoverings;
4. Identify any conflicts between adjacent components of the work that have potential to affect achieving the measurement tolerances required for individual contributions to the work;
5. Resolve issues and implement management controls associated with meeting specified tolerances;
6. Management of unit price allowances described by this Section associated with meeting specified tolerances;
7. Management of temporary heating to maintain optimal concrete curing, and management of temperature and humidity required for installation of applied finishes and floorcoverings; and
8. Other topics affecting the work described in this Section.

D. Pre-Construction Meetings: Conduct pre-construction meetings starting approximately 1 month before starting concrete work, and throughout the construction phase as necessary to achieve specified performance requirements in accordance with Section 01 31 00 – Project Management and Coordination, attended by Owner, Architect, Construction Manager, General Contractor and Subcontractors whose work is affected by work of this Section to discuss the following:

1. Best Practices Meetings: Confirm best practices relating to workmanship required to achieve specified floor finishing performance including the following:
   a. Sequence of work and confirmation of compatibility of installed materials and substrates;
   b. Using forming methods that limit potential deviation from specified performance requirements;
   c. Using placing and finishing methods that limit potential deviation from specified performance requirements;
   d. Responsibility for completion of substrate preparation and ambient weather measurements performed by Subcontractor.
   e. Responsibility for measurements and testing performed by Testing Agency described in this Section;
   f. Installation follow-up procedures to reduce or eliminate substrate and installation deficiencies;
   g. Using experienced, trained or certified Subcontractors for components critical to achieving specified performance requirements;
   h. Other procedures identified during best practices meetings that affect work results described in this Section.
2. Flatness/Levelness Surveying: Confirm access and survey frequency for collection of finishing tolerances for concrete substrates specified in Section 03 30 00. Confirm floor slopes in areas indicated to be sloped on drawings.
3. Concrete Quantitative Tolerance (FF:FL): Confirm that Concrete Quantitative Tolerance meets requirements specified in Section 03 30 00 prepared at time of concrete placement;
4. Floorcovering Qualitative Tolerance (Straightedge): Confirm that Floorcovering Qualitative Tolerance meets requirements for floorcoverings listed in RELATED REQUIRMENTS, accounting for natural changes to flatness profile arising from shrinkage, curling or plastic deflection of concrete slabs, and installation of self-levelling compounds and surface preparation products;
5. Condition of Substrates: Confirm that concrete substrate conditions are acceptable to floorcovering manufacturer requirements for relative humidity, mechanical bond and porosity, smoothness and other conditions affecting quality of floorcovering installation;
6. Measurement and Testing Frequency: Determine frequency and timing of site testing and observation reporting of floorcoverings substrates to confirm acceptability for manufacturers installation requirements; and
7. Other topics affecting work described in this Section.

E. Coordination: Coordinate qualification requirements and contributions from Division 03 and requirements from Division 09 associated with interior concrete floor finishing performance as follows:
1. Coordinate concrete mix design and confirm workability of mix to achieve finishing tolerances for concrete substrates specified in Section 03 30 00, and confirm compatibility with bonding performance required by products specified in RELATED REQUIREMENTS.
2. Coordinate with concrete floor finishing Subcontractors and confirm they employ sufficient numbers of qualified and experienced personnel during concrete placement operations to achieve finishing tolerances for concrete substrates specified in Section 03 30 00
3. Coordinate concrete curing methods proposed for use on the Project as specified in Section 03 30 00 with RELATED REQUIREMENTS and confirm that curing methods and materials, and substrate remediation methods are compatible with installation of floorcoverings and other applied finishes.
4. Coordinate requirements for measurements, testing and preparation of concrete substrates as specified in Section 03 30 00 and Section 09 05 61.
5. Coordinate with Subcontractors responsible for cementitious topping and underlayments Subcontractors and confirm methods for unit price allowance management, contributions to floor finishing mock-up specified in this Section and confirm products proposed for use.
6. Coordinate Subcontractors contributing to floor finishing mock-up described in this Section.

F. Scheduling: Schedule concrete placing and finishing to account for floor finishing performance requirements described in this Section and required by RELATED REQUIREMENTS, and as follows:
   1. Schedule delivery of concrete to prevent use of unscheduled water and additives being added to the mix during transport or as a consequence of delays at time of discharge without prior approval from Construction Manager.
   2. Schedule concrete formwork removal in accordance with Section 03 30 00, early removal of formwork will not be permitted unless specifically directed by the Construction Manager.
   3. Schedule concrete placing and finishing operations to minimize exposure to adverse weather conditions in accordance with CSA A23.1, Article 7.6.
   4. Schedule measurements and testing performed by Subcontractors responsible for work results specified in RELATED REQUIREMENTS.

1.06 SUBMITTALS

A. Provide required information in accordance with Section 01 33 00 Submittal Procedures.

B. Information Submittals: Provide the following submittals during the course of work of this Section:
   1. Concrete Placing and Finishing Records: Submit written records for each concrete placement including the following:
      a. Volume, location and date of concrete placement relating to gridlines indicated on Drawings;
      b. Weather conditions on date of concrete placement;
      c. Building enclosure conditions on date of concrete placement;
      d. Temperature of granular base for slabs-on-grade, or ambient temperature of formwork substrate; and
      e. Any unusual observations or conditions affecting concrete placement.
   2. Substrate Condition and Compatibility Report: Submit confirmation that substrate conditions and applied curing agents are acceptable for specified floorcoverings.
   3. Survey Data: Submit floor flatness/floor levelness reports in format described in 01 33 00 at intervals specified in this Section.

1.07 QUALIFICATIONS

A. Concrete Finisher Qualifications: Engage Subcontractors that can coordinate supply and installation of concrete formwork and reinforcing steel, concrete placing and finishing, curing and jointing in a coordinated-source arrangement, and as specified in Section 03 30 00.

B. Floorcovering Installer Qualifications: Engage floorcovering Subcontractors that have at least 5 years experience in installations similar to this project and approved by the product manufacturers to install their products.
   1. Subcontractor’s Responsibility: Perform work of this section in accordance with specified requirements.

1.08 WARRANTY

A. Special Warranty – Concrete Floor Finishing: Submit warranty covering surface deterioration, dusting and cracking for a 2 year period, starting from the date of Substantial Completion of the Work.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Concrete Floor Finishing: Refer to Section 03 30 00 for concrete slab finishing requirements.

B. Applied Finishes Installation: Refer to RELATED REQUIREMENTS associated with applied finishes work.

C. Floorcovering Installation: Install floor preparation materials and floorcoverings products in accordance manufacturer’s written instructions and requirements described in RELATED REQUIREMENTS associated with floorcovering work.

D. Self-Levelling Underlayment Installation: Account for sufficient self-levelling underlayment compounds for improved surface tolerance floors as follows:

Calculated Effect of Deflection on Floor Flatness (FF)

Deflection Span Ratio	Deflection of a 9 metre span	Final FF Number			
Initial (FF) – No Deflection		50	40	30	25
L/960	10 mm	39	34	28	24
L/480	19 mm	25	23	21	19
L/360	25 mm	20	19	19	16
Calculated Percent Decrease from Optimal Flatness					
L/960	10 mm	24%	15%	7%	4%
L/480	19 mm	51%	43%	30%	24%
L/360	25 mm	61%	53%	37%	36%

1. Calculated Floor Elevation Profile Deviation: Concrete Quantitative Tolerance specified in Section 03 30 00 will change between the time it was first measured (preliminary) and when measurements are taken before floorcoverings and applied finishes are installed (final) as follows:
   a. Slabs-on-Grade: Account for a maximum 20% deviation from measured Concrete Quantitative Tolerance of slabs-on-grade, and include for specified floor levelling products to re-establish Floorcovering Qualitative Tolerance (Straightedge) required by floorcovering manufacturers as a part of Bid Price.
   b. Suspended Slabs: Account for a maximum 25% deviation from measured Concrete Quantitative Tolerance of suspended slabs, and include specified floor levelling products to re-establish Floorcovering Qualitative Tolerance (Straightedge) required by floorcovering manufacturers as a part of Bid Price.
2. Observed Floor Elevation Profile Deviation: Confirm calculations for expected deviation from specified concrete finishing tolerances before application of specified floor levelling products and adjust quantity using unit price allowances submitted with Bid to establish final surface profile required for specified floorcoverings:
   a. Unit price allowance will be used to adjust cost for specified floor levelling products based on the differential between calculated and observed concrete finishing tolerances.
   b. Unit price allowance will be applied as an addition or deduction to floor levelling products included as a part of the Bid Price.

PART 3 EXECUTION

3.01 EXAMINATION

A. Concrete Testing: Refer to Section 03 30 00 for testing associated with concrete quality.

B. Substrate Testing: Refer to Section 09 05 61 for testing associated with moisture emissions, surface porosity and alkalinity, and adhesive compatibility of concrete substrates before installation of floorcovering materials.

C. Concrete Finishing Tolerances Survey: Survey concrete slabs based on concrete finishing tolerances tolerance standards applicable to the work described in individual RELATED REQUIREMENTS:
   1. Concrete Quantitative Tolerance (FF:FL) Measurements: Measure concrete substrate and confirm they meet project requirements specified in Section 03 30 00.
   2. Floorcovering Qualitative Tolerance (Straightedge) Measurements: Measure concrete substrate and confirm they meet project requirements specified in Section 09 05 61.

3.02 PROTECTION

A. Temperature and Humidity Controls during Construction: Contractor will install indirect temporary heating sources for building interior spaces in accordance with the flooring materials Manufacturer's requirements, capable of maintaining consistent and controllable temperature, and maintaining temperature of substrates at a minimum of 3°C above air dew point.

B. Protection of Concrete Substrates: Contractor will protect concrete substrate surfaces during construction to minimize surface contamination and provide a surface that is compatible with

floorcovering manufacturers installation tolerances, and correct differential between Concrete Quantitative Tolerance (FF:FL) and Floorcovering Qualitative Tolerance (Straightedge) in accordance with Section 09 05 61, free from alkali, dust and dirt, adhesives, paints and coatings, solvents and oils, grease, wax, form release agents, film forming sealers and curing aids, and film forming hardening compounds that are incompatible with flooring adhesives.

3.03 ALIGNING DIFFERENTIAL TOLERANCES

A. Contractor is responsible for managing coordinated-source concrete placing, finishing and curing of concrete described in this Section in accordance with CSA A23.1, Part 7 and the following:
   1. Contractor will establish control points for floor measurements [and arrange for point cloud surveying] as a component of their QMP provisions to quantify amount of materials required to meet Floorcovering Qualitative Tolerance (Straightedge).
   2. Contractor will manage Subcontractors contributions for site measurements of concrete slabs to establish Concrete Quantitative Tolerance and Floorcovering Qualitative Tolerance (Straightedge).
   3. Contractor will notify Owner, Construction Manager and Architect of differential between calculated concrete finishing tolerances to observed concrete finishing tolerances; Consultant will provide written direction for adjustment to unit price allowance.
   4. Contractor prepares or adds content to their QMP that describes their approach for identifying and correcting deficient work.

B. Subcontractor's Contributions: Subcontractors are responsible for managing surface tolerance requirements contained within their RELATED REQUIREMENTS as follows:
   1. Subcontractor will perform measurement and testing specified in RELATED REQUIREMENTS associated with their work result.
   2. Subcontractor will confirm the Contractor's QMP modifications following pre-construction meetings specified above that they require to achieve specified tolerances.

C. Manufacturers' Contributions: Manufacturers will provide written instructions to Subcontractors identifying product installation requirements including modifications to standard procedures, measurements and testing necessary to achieve specified concrete floor finishing performance requirements.

3.04 SITE QUALITY CONTROL

A. Measurement and Testing: Site quality control requirements are specified in RELATED REQUIREMENTS, and describes measurement and testing responsibilities of Owner, Contractor and Subcontractors.

B. Contractor's Quality Management: QMP will list measurements and testing, and identify Subcontractors responsible for site quality control requirements required to achieve floor finishing performance requirements identified in this Section.

C. Owner's Quality Audit: Owner may engage services of a third-party observation and testing agency to perform quality auditing services necessary to validate Contractor's quality assurance and quality control procedures described in the QMP; scope of service provided by the Owner's quality auditor will be limited to the following:
   1. Quality auditor will notify Owner, Construction Manager and Architect of non-conforming work, irregularities or deficiencies observed during the performance of its services.
   2. Construction Manager and Contractor will discuss options for correction to non-conforming work with Subcontractor responsible for the work to determine appropriate recommendations for correction.
   3. Construction Manager will prepare written communication describing acceptable correction for non-conforming work and issue to the Owner, Contractor and Subcontractors responsible for the work.
   4. Quality auditor is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, make changes to manufacturer's written instructions, nor approve or accept any portion of the Work.

5. Owner's quality auditor will not be permitted to perform any duties of the Construction Manager or Contractor.

3.05 CLOSEOUT ACTIVITIES

A. Cleaning: Keep installed work clean as installation progresses and perform final cleaning as required by Section 01 77 00 Closeout Procedures, coordinated cleaning activities described in RELATED REQUIREMENTS.

B. Demonstration: Provide demonstration and training for Owner's personnel associated with specified floor finishes in accordance with Section 01 92 00 Facility Operation and Maintenance, coordinated with maintenance activities described in RELATED REQUIREMENTS.

END OF SECTION

SECTION 01 92 00
FACILITY OPERATION AND MAINTENANCE

PART 1 GENERAL

1.01 SUBMITTAL REQUIREMENTS

A. Submittal of Operation and Maintenance Data shall follow the procedures specified in Section 01 33 00 Submittal Procedures.
   1. Operation and Maintenance Data shall be reviewed by the owner and will be returned for revision if incomplete or incorrectly formatted.

B. Operations and Maintenance Manual:
   1. The Contractor shall compile O&M manuals for every piece of equipment/system with the following format:
      a. Format: All documents shall be submitted in their native digital format.
         1) Drawings shall be VISIO or AutoCAD format.
         2) All other documents shall be in the Portable Document Format (PDF). PDFs shall be native, no scans, and OCR searchable.
         3) The O&M in its entirety shall be turned over to Operations on a portable memory device.
      b. There shall be separate files for each document, with a hyperlink from the Table of Contents.
      c. There shall be a title page and a table of contents in the front of each “binder”. In each binder, there shall be a main tab for each specification section. Behind the section number tab there shall be the equipment ID tag sub-tab for each piece of equipment. These sub-tabs shall match the specification numbers. Behind each equipment name tab shall be the following sections, in the given order, labeled with the title of the section.
         1) Contractor. The first page behind the equipment tab shall contain the name, address and telephone number of the manufacturer and installing contractor and the 24-hour number for emergency service for all equipment in this section, identified by equipment.
         2) Submittal and Product Data. This section shall include all approved submittal data, cut sheets and appropriate shop drawings. If submittal was not required for approval, descriptive product data shall be included.
         3) Model/Serial number. All items installed shall be identified by model and serial number, if applicable.
         4) Operation and Maintenance Instructions. These shall be the written manufacturer’s data with the model and features of this installation clearly marked and edited to omit reference to products or data not applicable to this installation. This section shall include data on the following:
            (a) Installation, startup and break-in instructions.
            (b) All starting, normal shutdown, emergency shutdown, manual operation, seasonal changeover and normal operating procedures and data, including any special limitations.
            (c) O&M and installation instructions that were shipped with the unit.
            (d) Preventative maintenance and service procedures and schedules.
            (e) Troubleshooting procedures.
            (f) A parts list, edited to omit reference to items which do not apply to this installation.
            (g) A list of any special tools required to service or maintain the equipment.
            (h) Performance data, ratings and curves.
            (i) Warranty, which clearly lists conditions to be maintained to keep warranty in effect and conditions that would affect the validity of the warranty.
            (j) Any service contracts issued.
         5) Supplemental Data. Prepare text and/or special drawings to provide necessary information, where manufacturer’s standard printed data is not available and information is necessary for a proper understanding and operation and maintenance of

equipment or systems, or where it is necessary to provide additional information to supplement data included in the manual or project documents.

6) Automation Drawings. Include the diagrams for all equipment and its components, including the sequence of operations. This section will be provided by the Division 25 contractor.

d. Test and Balance (TAB) Report: The TAB Contractor has specific TAB Report requirements, detailed in Section 23 05 93, that shall be included in this section.

e. Design Architect and Engineers' Calculations: The Architects and Engineers have project specific design data that shall be included in this manual.

2. Commissioning Manual.

a. Refer to O&M documentation requirements identified in this section, in Section 01 91 13 and other Commissioning specific sections.

b. Commissioning Report and Testing Data. Compile a separate manual dedicated to documenting the Commissioning Process which will include all verification and testing data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes general requirements that apply to the implementation of the Commissioning Process and the contractors' participation in this process. Commissioning is systematic process to provide documented confirmation that the facility's systems are installed in accordance with construction documents, manufacturer's recommendations, perform according to the criteria set forth in the design documents and satisfy the Owner's Project Requirements.

B. This goal is achieved with the process starting during preliminary design phase by documenting the Owner's Project Requirements, the Basis of Design; and continues throughout the construction phase. The process culminates with turnover and Owner Acceptance, achieved through verification of system functional and performance testing.

C. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
   1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
   2. Verify and document proper performance of equipment and systems.
   3. Verify that O&M documentation left on site is complete.
   4. Verify that the Owner's operating personnel are adequately trained.

D. 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 facility.

1.02 REFERENCED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Commissioning Plan.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

B. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

C. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

D. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

E. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. Acceptance: A contractually defined action that permits an activity to commence or continue.

B. Basis of Design (BoD): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements 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. Commissioning Activity: A component of the Commissioning Process.

D. Commissioning Provider (CxP): A person employed by Life Time, or contracted to, who plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

E. Commissioning Technician (CxT): A person employed by, or contracted to, Life Time who executes specific Commissioning Activities, under the direction of the CxP.

F. Commissioning Field Report: A document that records the activities and results of the Commissioning Process.

G. Commissioning Plan (Cx Plan): A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

H. Commissioning Process (Cx): A quality assurance process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

I. Commissioning Team: The individuals, who through coordinated actions, are responsible for implementing the Commissioning Process.

J. Construction Documents: This includes a wide range of documents, which will vary from project to project, owner's needs, regulations, codes, and countries. Construction documents usually include the project manual (specifications), plans (drawings) and General terms of the contract, especially those required by subcontractors and vendors, suppliers and manufacturers of equipment, assemblies, and systems.

K. Coordination Drawings: Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

L. Functional Performance Test (FPT): The process of testing system integration using written test procedures. The functional test is performed during the last phase of the project. This is often referred to as a final quality control test, which is done to ensure that design specifications have been incorporated. During testing, how a system responds to changes in setpoints or changes to controlled variables is tested. Functional testing is dynamic testing of the entire system not only its components.

M. Issues Log: A formal and ongoing record of problems or concerns, and their resolution, which have been raised by members of the Commissioning Team during the Commissioning Process.

N. Nominal Group Technique: A formal, structured brainstorming process used to obtain the maximum possible ranked input from a variety of viewpoints in a short period of time. The typical approach is a workshop session where a question is presented, the attendees record their responses individually on a piece of paper, the individual responses are recorded on a flip chart without discussion in a round-robin fashion, all the responses are discussed, and then the individuals rank their top five responses.

O. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This can include project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

P. Pre-Functional Checklist (PFC): A form used by the contractor to verify that appropriate components are on-site, ready for installation, correctly installed, and functional. Pre-functional testing is static testing of components of a system to verify installation and the readiness for Functional testing.

Q. Probabilistic Tools: Tools and methods based upon an estimated, uniform or known probability/statistical distribution of outcome that can be predicted or an underlying outcome

distribution that can be expected or estimated. The distribution of outcome should be within a reasonably close range to the mean expected outcome or measured value, be it known or estimated.

R. Systems Manual: A system-focused composite document that includes the Commissioning Record, operation manual, maintenance manual, and additional information of use to the owner during the Occupancy and Operations Phase.

S. Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

T. Training Plan: A written document that details the expectations, schedule, budget, and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.

U. Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner’s Project Requirements.

V. Web-based Commissioning Software (WCxS): Cloud-based software that the CxP utilizes to manage the Cx process and the Cx Team.

1.05 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning Provider (CxP), the Owner's Representative (OR), the General Contractor (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Automation Contractor (AC), any other installing subcontractors or suppliers of equipment. If known, the Owner’s building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CxP is hired by the Owner directly. The CxP directs and coordinates the commissioning activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the OPR.

C. Scheduling. The CxP will work with the GC according to established protocols to schedule the commissioning activities. The CxP will provide sufficient notice to the GC for scheduling of commissioning related activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

D. The CxP will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan - Construction Phase provides a format for this schedule. As construction progresses more detailed schedules are developed by the CxP. The Commissioning Plan also provides a format for detailed schedules.

1.06 COMMISSIONING PROCESS

A. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
   1. Commissioning during construction begins with a scoping meeting conducted by the CxP where the commissioning process is reviewed with the commissioning team members.
   2. Additional meetings will be required throughout construction, scheduled by the CxP with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
   3. Equipment documentation is submitted to the CxP during normal submittals, including detailed start-up procedures.
   4. The CxP reviews startup plans and startup documentation formats provided by the vendors.
   5. The CxP provides the Subs with Pre-Functional Checklists to be completed, during the startup process.
   6. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and inter-system levels with Pre-Functional Checklists being completed before functional testing.

7. The Subs, under the General Contractors direction, execute and document the Pre-Functional Checklists and perform startup and initial checkout. The CxP documents that the checklists and startup were completed according to the approved plans. This may include the CxP witnessing startup of selected equipment.
8. The CxP develops specific equipment and system Functional Performance Test procedures. The Team reviews the procedures.
9. The test procedures are executed by the CxP, with assistance of pertinent Team members.
10. Items of non-compliance in material, installation or setup are corrected and the system is retested.
11. The CxP reviews the O&M documentation for clarity and completeness.
12. Functional Performance Testing is successfully completed before Owner Acceptance is granted.
13. The CxP reviews, approves, and documents the training provided by the Vendors/ Contractors.
14. Deferred testing is scheduled and/or conducted, as required.

1.07 COMMISSIONING TEAM

A. Members Appointed by Contractors: Individuals, each having the authority to act on behalf of the entity they represent, explicitly organized to implement the commissioning process through coordinated action. The commissioning team members shall consist of, but not be limited to, contractors, subcontractors, installers, suppliers, and specialists deemed appropriate by the CxP.

B. Members Appointed by Owner:
1. CxP: The designated person 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. The Owners Representative.
4. Architect and engineering design professionals.

1.08 RESPONSIBILITIES

A. Owner: Responsibilities of the Owner include, but are not limited to the following:
1. Provide the OPR documentation to the CxP and General Contractor for information and use.
2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxP and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
4. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan - Construction Phase.
5. Follow the Commissioning Plan.
6. Attend commissioning scoping meetings and additional meetings as necessary.

B. The Owner's Representative OR shall represent the Owner during the commissioning process as follows:
1. Manage the contract of the A/E, and Contractors.
2. Provide final approval for the completion of the commissioning work.
3. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
4. Follow the Commissioning Plan.
5. Attend commissioning scoping meetings and additional meetings as necessary.

C. Commissioning Provider: Responsibilities of the CxP include, but are not limited to the following:
1. Coordinate and direct each step of the Commissioning Process for systems being commissioned for this project. Coordinate commissioning work schedule with construction Project Manager and/or Contractors.
2. Attend planning and job-site meetings as required to obtain information relating to Commissioning Process.
3. Plan and conduct commissioning scoping and coordination meetings. Provide notice to all Team members to attend scheduled commissioning meetings.

4. Ensure all information required for Commissioning Process from manufacturers, Contractors, and A/E design team is available.
5. Review A/E design documents to gain clear understanding of design intent.
6. Review Contractor submittals for compliance with commissioning needs.
7. Review Contractor process for as-built documentation.
8. Verify that systems and equipment have been installed and started in accordance with manufacturer's recommendations and with generally recognized construction standards and that documentation of such has been provided.
9. Prepare and provide Pre-Functional Checklists to ensure systems have been installed according to project specifications. Verify that Pre-Functional Checklists have been completed by Contractors and are accurate.
10. Prepare and provide Functional Performance Test procedures to demonstrate performance of systems according to project specifications. Observe and document performance of systems, as per process detailed in Functional Test procedures.
11. Review Testing and Balancing (TAB) reports.
12. Decide acceptance or non-acceptance of systems.
13. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
14. Ensure that seasonal or deferred testing and deficiency issues are addressed.
15. Verify that Operations and Maintenance (O&M) documentation is complete. Operations and Maintenance manuals shall be submitted simultaneously to CxP and to Design Team for review.
16. Verify that Owner training is completed for all systems.
17. Compile and maintain Commissioning Issues Log.
18. Provide Final Commissioning Report.

D. General Contractor: Responsibilities of the GC as relate to the Commissioning Process include, but are not limited to the following:
1. Facilitate the coordination of the commissioning work and incorporate commissioning activities (the Cx Plan) into the overall project schedule.
2. All costs associated with the participation of Contractor, Sub-Contractors, and Equipment Vendors in the Commissioning Process shall be included in the scope of this contract.
3. Attend Commissioning meetings or other meetings called by CxP to facilitate the Commissioning Process.
4. Provide all documentation relating to manufacturer's recommended performance of equipment and systems.
5. Provide Operations and Maintenance Data to CxP for preparation of checklists and test procedures.
6. Review commissioning progress and deficiency reports.
7. Provide Testing and Balancing Report.
8. Assure and facilitate participation and cooperation of subcontractors (electrical, mechanical, automation, fire alarm, etc.) and equipment suppliers as required for the Commissioning Process.
9. Certify to CxP that installation work listed in Pre-Functional Checklists has been completed.
10. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and Pre-Functional Checklists.
11. Provide copy of vendor completed start-up forms for equipment and systems.
12. Ensure systems have been started and fully checked for proper operation prior to scheduling Functional Performance Testing with CxP.
13. Contractors shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether they are specifically listed in Functional Test procedures.
14. Contractor is not relieved of obligation for systems/equipment demonstration of performance, where a Functional Performance Test is not specifically designated by CxP.
15. Coordinate with CxP to determine mutually acceptable date of Functional Performance Tests.
16. Provide test instruments and communications devices, as prescribed by CxP, required for carrying out Functional Performance Testing of systems.

17. Evaluate and ensure deficiencies shown in the Commissioning Issues Log are corrected within the time allowed for the project.
18. Provide CxP with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process.
19. Prepare and submit to CxP Training Program outline for each system.
20. Coordinate and provide training of Owner's personnel.
21. Execute and ensure subcontractors aid with seasonal or deferred Functional Performance Testing witnessed by the CxP.
22. Prepare Operation and Maintenance manuals and As-Built drawings in accordance with specifications; submit copy to CxP in addition to other contractually required submissions.

E. Subcontractors:
1. Prepare and submit to CxP proposed Installation and Startup procedures, to demonstrate performance of systems according to these specifications.
2. Execute Pre-Functional Checklists for appropriate equipment and systems.
3. Provide assistance in equipment testing at the request of the CxP.
4. Attend commissioning meetings as requested by the CxP.
5. Respond to (in writing) and address items documented in the Contractor Commissioning Issues Log.
6. Notify the GC a minimum of two weeks in advance of system start-up and testing, so CxP may be on site to witness.
7. Notify the GC a minimum of two weeks in advance, of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures.

F. Architect: Responsibilities of the Architect as related to the Commissioning Process shall include, but are not limited to the following:
1. Attend commissioning scoping meeting and other commissioning team meetings as requested by CxP.
2. Perform normal submittal review, construction observation, record drawing preparation, and operations and maintenance data preparation.
3. Provide design narrative documentation requested by CxP.
4. Coordinate resolution of system deficiencies identified during commissioning.
5. Prepare and submit final as-built design intent documentation for inclusion in Operation and Maintenance Manual, and review and approve Operation and Maintenance Manual.
6. Warranty Period: Coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

G. Mechanical, Electrical, Plumbing, Automation, and Specialty Engineers: Responsibilities of the Engineers as related to the Commissioning Process shall include, but are not limited to the following:
1. Perform detailed submittal review, construction observations, and record drawing preparation.
2. Perform site observation immediately preceding system startup.
3. Provide design narrative and sequence documentation requested by CxP. Assist in clarifying operation and control of commissioned equipment in areas where specifications, control drawings, or equipment documentation are not sufficient for writing detailed testing procedures.
4. Attend commissioning scoping meetings and other commissioning team meetings as requested by CxP.
5. Participate in resolution of system deficiencies identified during commissioning.
6. Prepare and submit final as-built design intent and operating parameters documentation for inclusion in Operation and Maintenance Manual, and review and approve Operation and Maintenance Manual.

1.09 COMMISSIONING DOCUMENTATION

A. General:
1. Timely and accurate documentation of commissioning activities is essential for the commissioning process to be effective. To this end, all commissioning activities conducted by the contractors shall be documented as outlined below and in Part 3 Execution of this specification.

2. Contractor commissioning responsibilities on Web-based Commissioning Software (WCxS) (Such as CxAlloy) include the following items:
   a. Construction Issues.
   b. Pre-Functional Checklists.
   c. Functional Performance Tests.
3. The GC is responsible to review all Construction Commissioning Issues on WCxS with their subcontractors and provide feedback on WCxS in a timely manner.
4. The pre-functional checklists shall be completed by each respective trade contractor involved with the installation of any commissioned systems and equipment.
5. The functional performance tests will be completed by the CxP as they witness the test conducted by the contractors.
6. All Contractor Commissioning Documents prepared by the contractors will be fully completed in a neat and workmanlike manner so as to be fully legible. Documentation which, at the CxP's discretion, is incomplete or less than fully legible shall be deemed unacceptable.
7. Commissioning procedures and tests, which are rejected by the CxP due to incomplete, or illegible contractor documentation shall be repeated by the contractor and new Contractor Commissioning Documents shall be prepared to the Commissioning Team's satisfaction at no additional cost to the Owner.
8. Procedures deemed unacceptable by the Commissioning Team after being repeated due to inadequate documentation may be subject to completion by the CxP, at a cost to the contactor as outlined in item Section 3.10 "Cost of Re-Evaluation" below.
9. All Contractor Commissioning Documents shall be completed on the job-site concurrent with the activities being documented. Remedial documentation of commissioning activities either off-site or after the procedures have been completed is unacceptable.
10. All Contractor Commissioning Documents will be submitted to the CxP for review and acceptance upon completion.

B. Contractor Commissioning Process Status Tracking.
   1. Contractors shall be responsible for monitoring the progress of their commissioning activities. The contractor will update the status of issues, checklists and tests on WCxS.
   2. The CxP will assist the contractor in using WCxS.
   3. The contractors shall regularly update WCxS and upload drawings or pictures as commissioning activities are completed so as to provide a readily available report to CxP regarding current status of the contractors commissioning activities.

C. Record Drawings.
   1. Contractors shall regularly update a 'redlined' set of record drawings showing commissioned systems as work is being installed so that the drawings remain current with the field work, and as required in Division 21, 22, 23, 25 and 26 of the project specifications.
   2. Redlining record drawings at the end of construction shall not be acceptable.
   3. The Contractors up-to-date, in-progress redlines shall be kept on-site in the Contractor's field office and available for review by the Cx Team.

D. Access to Contractor Documentation.
   1. Contractors shall provide the CxP with access to shop drawings, coordination drawings, equipment cut-sheets, schematics, in-progress record drawings, manufacturers installation-operation-maintenance manuals, startup reports, etc. to assist the CxP in execution of the Cx process.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. All industry standard test equipment required for performing the specified tests shall be provided by the applicable contractor (as specified) and shall be approved by the CxP. Any proprietary vendor specific test equipment shall be provided by that vendor or manufacturer.

B. Any portable or hand-held setup / calibration devices required to initialize the control system shall be made available by the control vendor (at no cost) to the CxP.

C. The instrumentation used in the commissioning process shall meet the following standards:
   1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required.
   2. Be calibrated at the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument.
   3. Be maintained in good repair and operating condition throughout the duration of use on this project.
   4. Be immediately re-calibrated or repaired if dropped and/or damaged in any way during use on this project.

2.02 BAS HARDWARE AND SOFTWARE

A. Field Panel Software and Hardware:
   1. The BAS Contractor shall furnish the CxP with all hardware and software needed to connect to, communicate with and command the BAS field panels and controllers at no additional charge to the CxP. This hardware and software will be used by the CxP for execution of the commissioning process. Software and hardware provided to the CxP for this purpose, does not include any provisions for use by the Test & Balance Contractor.
   2. Hardware and software covered under this requirement includes, but is not limited to:
      a. Latest versions of proprietary software needed to communicate with BAS field panels and controllers.
      b. Communication modules, software keys, and similar hardware needed for communication from a laptop computer, PDA or similar device to field panels or controllers.
      c. Proprietary cables required for communication between laptop computers or PDAs to field panels or controllers.
      d. Passwords, access levels and similar software permissions necessary for execution of the Cx Process.
      e. Software and hardware manuals for all control system hardware and software provided to the CxP.
   3. This requirement is not meant to include provision of standard hardware such as laptop computers and PDAs nor provision of standard software such as Windows or MS Explorer.
   4. At the conclusion of the Commissioning Process, this hardware and software will be turned over back to the contractor.

B. Operator Workstation Access:
   1. The BAS Contractor shall provide the CxP with software and hardware needed for accessing the BAS' front-end operator workstation(s). At a minimum, this shall include appropriate level user identification names and passwords. Access level shall allow the CxP to fully execute all commissioning procedures and will include the ability to:
      a. View system operation.
      b. Override setpoints.
      c. Command digital and analog output points.
      d. View BAS programming source code (read-only).
      e. View and print graphics.
      f. Create, view, modify, print and download trend logs, histories and reports.

C. Technical Support:
   1. The BAS Contractor shall also provide technical support to the CxP as reasonably requested by the CxP regarding setting up and operating BAS hardware and software to support successful execution of the Cx Process.

D. Duration of Support:
   1. The BAS Contractor shall provide the CxP with technical support for the duration of the project and through the post occupancy phase commissioning activities and warranty period of the project to support the Cx process. The duration of this support is typically one year after turn over to the owner, to provide time to complete deferred and seasonal testing and the warranty phase activities.

PART 3 EXECUTION

3.01 GENERAL

A. Contractor shall coordinate with subcontractors and equipment vendors to set aside adequate time to address Pre-Functional Checklist execution, Functional Performance Testing, Operations and Maintenance Training, and associated coordination meetings.

B. CxP may also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be addressed by appropriate contractor.

3.02 COMMISSIONING PLAN AND SCHEDULE

A. The CxP shall generate a commissioning plan which identifies Cx tasks, roles and responsibilities for the Cx process. The CxP will submit a Cx schedule for the commissioning process which shall be integrated into the construction schedule by the GC.

3.03 CONSTRUCTION OBSERVATION

A. This is an additional and separate activity from that provided by the design team. Construction observation is required as part of the commissioning and coordination process to be provided by the CxP. Field Observation reports will be distributed through the WCxS.

3.04 COMMISSIONING ISSUES LOGS

A. As part of the commissioning process, all issues will be recorded on the WCxS. The WCxS will divide the issues as follows:
   1. Design Commissioning Issues:
      a. This log is part of the Web-Based Commissioning Software. This log is a formal and ongoing record of issues pertaining to the project construction documents which identifies areas of concern with the design regarding to coordination between divisions, constructability, maintenance clearances, operability or other commissioning concerns. This log specifically separates design issues from contractor issues. The contractor has no responsibility to track or comment on the design team Cx log.
   2. Construction Commissioning Issues:
      a. This log is also a part of the Web-Based Commissioning Software. It is a formal and ongoing record of problems or concerns pertaining to the installation of the commissioned systems and equipment which identifies where the contractors have deviated from the OPR, contract documents, applicable codes or normal industry construction practices. It is the GC's responsibility to regularly login and retrieve this log from the Web-Based Commissioning Software, follow up and review each item on the list with the appropriate trades, and respond to the CxP with feedback within 5 business days from the issuance of the log from the CxP.
      b. Team members will be given access through the WCxS to comment on issues. This is where the GC should provide feedback which includes the following sections:
         1) Response/Action: This is the contractor’s response to the issue identified by the CxP.
         2) Trade: This identifies the specific contractor responsible for the correction of the issue. The issue will be assigned to that contractor or subcontractor.
         3) Expected Completion Date: This is the date which the GC and subcontractor agree the issue will be resolved by. This provides information back to the CxP as to when items should be corrected by for spot checking the correction of issues.
      c. The GC shall provide feedback and updates to the construction Cx issues log to the CxP within 5 business days from its issuance from the CxP.
      d. The CxP will back check a construction issue one (1) time after being told it’s complete. If the item is not complete after being told it’s complete, the CxP reserves the right to require the GC and associated sub-contractor to accompany the CxP on all future back checks on the project.
      e. The CxP will maintain the master Cx log on the WCxS.

3.05 MEETINGS

A. A commissioning team scoping meeting shall be held at a time and place agreed upon shortly after the beginning of the construction phase of the project. Owner, CxP, General Contractor, Architect, Mechanical Contractor, Automation Contractor, and Electrical Contractor shall be present at this meeting. The purpose of the meeting is to familiarize all parties with the requirements of the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

B. Separate meetings including individual equipment suppliers and subcontractors shall be held prior to commissioning of their systems at the discretion of CxP.

C. The CxP shall plan and conduct other meetings as required as construction progresses. Meetings will cover coordination, deficiency resolution, and planning issues with subcontractors. CxP will plan meetings to minimize unnecessary time being spent by subcontractors.

3.06 SYSTEM START-UP

A. Contractors will arrange for start-up of operating equipment and systems prior to scheduling Functional Performance Testing.

B. Start-up of equipment and systems shall be performed only by a manufacturer’s representative, or persons who are specifically manufacturer approved. All start-up personnel shall be trained and authorized, experienced and knowledgeable in the operations of such equipment and systems.

C. Coordinate schedule for start-up of various equipment and systems so that sub-systems required for major systems operation are tested first.

D. Manufacturer’s start-up reports must be submitted to CxP prior to scheduling Functional Performance Testing.

3.07 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Pre-Functional Checklists are important to ensure that equipment and systems are properly connected and installed in accordance with specifications, drawings, manufacturer's requirements, and all applicable codes.

B. Checklists shall reside on the WCxS and shall be created by the CxP, for the Contractors to execute.

C. Checklists ensure that functional performance testing may proceed without unnecessary delays.

D. Completion of PFCs shall be executed by the contractors. Only individuals that have direct knowledge and who witnessed that line item task on PFC was performed shall initial item.

E. Each piece of equipment or system a receives PFC form. No sampling strategies are used.

F. PFC for a given system must be successfully completed prior to commencement of Functional Performance Testing of equipment or sub-systems.

G. PFC tasks shall be documented in a checklist format, as prepared and provided by CxP, for each piece of equipment. Each checklist shall be signed by the contractors.

H. CxP provided PFCs shall not preclude Contractor from applying their own construction inspection checklists and quality control.

I. All system elements shall be checked to verify that they have been installed, adjusted, and calibrated properly, that all connections have been made correctly, and that it is ready to function as specified.

J. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, control sequence, and other conditions which may cause damage.

K. Verify that tests, meter readings and specific electrical characteristics agree with those required by equipment or system manufacturer.

L. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation. Verify wiring and support components for equipment are complete and tested.

M. Conduct start-up procedure recommended by equipment/system manufacturer. Attach a copy of the start-up procedure report as a File to the PFC form on the WCxS.

N. Contractors shall clearly list outstanding items of initial start-up and Pre-Functional Checklists that were not completed successfully at bottom of procedures form or on separate sheet attached to form.

O. Completed forms shall be provided to CxP within 5 days of completion. Installing subcontractor shall correct deficient or incomplete areas in timely manner and shall submit startup reports with statement of correction on original non-compliance report.

3.08 TESTING AND BALANCING

A. Testing, Adjusting, and Balance Contractor (TAB) Requirements:
   1. Air and water balance shall be accomplished by an independent test and balance firm. The test and balance firm shall come back after the final balancing report is approved to work with the CxP and spot check this work to verify accuracy of results. Refer to Division 23 for acceptance criteria.
   2. Test and balance contractor to provide final balancing report to CxP.
   3. The TAB contractor shall be responsible for successful completion and documentation of all TAB activities specified in the Division 23.
   4. Prior to the start of TAB activities, the TAB contractor shall submit a proposed TAB plan, procedures and documentation to the CxP and A/E for review. TAB procedures shall be submitted to allow sufficient time for CxP review and approval prior to the start of TAB activities.
   5. After this review, and prior to start of field work, the TAB contractor will attend one or more planning meetings as required with the Commissioning Team to review and discuss outstanding issues relating to TAB procedures and forms, discuss resolution of issues identified during the TAB contractor's plan review and field inspections, and to coordinate field work.
   6. Prior to the start of fieldwork, the TAB contractor shall issue a final set of TAB procedures and TAB forms which incorporate any comments received during the Commissioning Team review.
   7. The TAB contractor shall have at least one certified field technician on site whenever TAB work is being performed.
   8. The TAB contractor is responsible to notify the GC who in turn shall notify the Commissioning Team a minimum of two (2) weeks in advance of the time for start of TAB work to allow the CxP and A/E time to assess system readiness.
   9. The TAB contractor will work cooperatively with the CxP.
   10. The TAB contractor shall coordinate with the controls contractor to ensure that changes made to the control system during TAB (flow coefficients, duct areas, etc.) are archived and become the default or initial values for these parameters.
   11. The TAB contractor shall provide daily lists of issues and/or problems identified during TAB work to the GC, CxP and A/E for follow-up & resolution with the appropriate contractors.
   12. Participate in verification of the TAB report, which may consist of repeating any selected measurement contained in the TAB report where required by the CxP for verification or diagnostic purposes.
   13. The TAB contractor will provide technicians and instrumentation to support the field verification.
   14. Instruments used for the field verification shall be the same instruments (by model and serial number) that were used for the original TAB work.
   15. Failure of an item during the TAB field verification is defined as:
      a. For all readings other than sound, a deviation of more than 10%.
      b. For sound pressure readings, a deviation of 3 decibels. (Note: variations in background noise will be considered).
   16. A failure of more than 10% or 10 (whichever is greater) of the readings tested during the field verification shall result in the rejection of the final TAB report and require re-balancing of the system(s) in question.

3.09 CONTROLS AND INSTRUMENTATION TESTING

A. Testing, Adjusting, and Balance Contractor (TAB) Requirements:
   1. Air and water balance shall be accomplished by an independent test and balance firm. The test and balance firm shall come back after the final balancing report is approved to work with the CxP and spot check this work to verify accuracy of results. Refer to Division 23 for acceptance criteria.

2. Test and balance contractor to provide final balancing report to CxP.
3. The TAB contractor shall be responsible for successful completion and documentation of all TAB activities specified in the Division 23.
4. Prior to the start of TAB activities, the TAB contractor shall submit a proposed TAB plan, procedures and documentation to the CxP and A/E for review. TAB procedures shall be submitted to allow sufficient time for CxP review and approval prior to the start of TAB activities.
5. After this review, and prior to start of field work, the TAB contractor will attend one or more planning meetings as required with the Commissioning Team to review and discuss outstanding issues relating to TAB procedures and forms, discuss resolution of issues identified during the TAB contractor's plan review and field inspections, and to coordinate field work.
6. Prior to the start of fieldwork, the TAB contractor shall issue a final set of TAB procedures and TAB forms which incorporate any comments received during the Commissioning Team review.
7. The TAB contractor shall have at least one certified field technician on site whenever TAB work is being performed.
8. The TAB contractor is responsible to notify the GC who in turn shall notify the Commissioning Team a minimum of two (2) weeks in advance of the time for start of TAB work to allow the CxP and A/E time to assess system readiness.
9. The TAB contractor will work cooperatively with the CxP.
10. The TAB contractor shall coordinate with the controls contractor to ensure that changes made to the control system during TAB (flow coefficients, duct areas, etc.) are archived and become the default or initial values for these parameters.
11. The TAB contractor shall provide daily lists of issues and/or problems identified during TAB work to the GC, CxP and A/E for follow-up & resolution with the appropriate contractors.
12. Participate in verification of the TAB report, which may consist of repeating any selected measurement contained in the TAB report where required by the CxP for verification or diagnostic purposes.
13. The TAB contractor will provide technicians and instrumentation to support the field verification.
14. Instruments used for the field verification shall be the same instruments (by model and serial number) that were used for the original TAB work.
15. Failure of an item during the TAB field verification is defined as:
    a. For all readings other than sound, a deviation of more than 10%.
16. A failure of more than 10% or 10 (whichever is greater) of the readings tested during the field verification shall result in the rejection of the final TAB report and require re-balancing of the system(s) in question.

3.10 FUNCTIONAL PERFORMANCE TESTS (FPT)

A. The objective of testing is to demonstrate that each system is operating according to documented design intent and Contract Documents, through all possible modes of operation.

B. Test forms shall reside on WCxS and shall be created by the CxP, for the CxP to execute, with assistance from the Contractors.

C. Contractor shall bear all costs associated with participation in the execution of testing procedures for all items listed in Part 3 of the related specifications.

D. Testing is intended to begin upon completion of each system. Testing may proceed prior to completion of systems or sub-systems at the discretion of CxP. Initiation of system testing, before completion, does not relieve Contractor from fully completing system, including Pre-Functional Checklist execution, as early as possible.

E. Testing shall be conducted under specified operating conditions as recommended or approved by CxP.

F. A separate test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of CxP in accordance with proposed test procedures developed to demonstrate compliance with specifications.

G. Each test shall be witnessed and signed off by CxP upon satisfactory completion.

H. All elements of system shall be tested to demonstrate that total systems satisfy all requirements of these specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by the entire system, followed by any inter-ties to other major systems.

I. All major testing materials and equipment shall be provided by contractor.
   1. Notify CxP, in writing, of request for scheduling Functional Performance Testing. Submit request no fewer than five (5) business days prior to desired day of testing.
   2. Contractor must certify that systems and equipment are functioning satisfactorily, according to specifications and design intent, prior to requesting testing. Upon receipt of such certification, CxP will schedule with Contractor a time for the particular system test.
   3. CxP will attempt to schedule testing when convenient for Contractor and its vendors, and to minimize lost time to Contractor.
   4. Contractor will resolve all deficiencies identified during initial test prior to submitting request, in writing, for re-testing. Such request for re-testing shall certify that Contractor has resolved all deficiencies, or list reason why any deficiencies remain which cannot be resolved.
   5. CxP will re-test to ensure that all deficiencies have been resolved.
   6. Deficiencies that were not detected in first Test, but are discovered in subsequent re-testing, are to be resolved by Contractor as if they had been discovered in initial testing.

J. Functional Performance Testing Requirements and Procedures:
   1. To facilitate Testing, Contractors shall provide personnel to accompany CxP as requested for Testing, including any follow-up testing. Such personnel must be experienced, qualified, and intimately familiar with the system being tested.
      a. Participation by representatives of the Automation contractor is of particular importance in Testing. All systems which are controlled and / or monitored by the IAS are to be thoroughly tested, point by point, through all modes of operation, with the assistance of the Contractor's representative. Graphics, setpoints, and programming are to be included as a part of Functional Testing as well.
      b. Contractors must provide personnel to accompany CxP for equipment and systems which may pose health and safety concerns, such as steam boilers.
      c. Should they fail to provide a representative to accompany CxP as requested during Testing, Contractor continues to bear full responsibility for equipment warranty.
   2. Each system shall be operated through all modes of operation including, but not limited to seasonal, occupied, unoccupied, warm-up, cool-down, part-load, and full-load, where system response is specified.
      a. For multiple units, sampling strategy established by CxP may be used.
      b. Verification of each sequence in Sequence of Operations is required.
      c. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, and the like, shall also be tested.
   3. Testing is to be dedicated solely to testing of equipment and systems, and not to resolution of deficiencies. Deficiencies identified during testing process must be corrected by Contractor at a time other than during Testing.
   4. CxP shall issue test reports with readings and checklists and a listing of any deficiencies that must be addressed by Contractor or Subcontractors.
   5. CxP shall submit a Final Report recommending acceptance or non-acceptance of individual system components as well as the systems as a whole.

K. Re-Testing and Failure to Remedy Deficiencies:
   1. It is expected that some deficiencies will be found during initial inspection and during Testing; such deficiencies are expected to be minimal.
   2. It is the Contractor's responsibility to remedy identified deficiencies, both in Pre-Functional and in Functional Testing phases of work, in a timely and thorough manner.
   3. It is the Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.

4. CxP may agree to re-testing systems or equipment where deficiencies remain, which are beyond Contractor's control to resolve expeditiously.
5. CxP will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.

3.11 COST OF RE-EVALUATION

A. The cost for Contractors to re-evaluate any Commissioning Procedure due to open issues shall be borne by the contractors.

B. The CxP will be available for two attempts of the Functional Performance Tests (one initial and one re-try) with minimal follow-up where necessary (due to deficiencies, systems not ready, incomplete work, etc.) to try to accomplish each test as part of the contract. When additional work is required because systems are not ready or because they do not successfully pass the FPT after they have been indicated as ready, the contractor will be charged for the CxP's additional ++retesting costs. Additional fees will be paid to the CxP by the Owner and shall be reimbursed by the Contractor.

C. Any required re-testing by any contractor shall not be allowed as a justified reason for a claim of delay or for a time extension by the contractor.

3.12 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The CxP shall review the draft form of the O&M manuals provided by the trade contractors with commissioning scope. The review process shall verify that O&M instructions meet specifications and are included for all equipment furnished by the contractor, and that the instructions and wiring diagrams are project specific (edited where necessary) to the actual equipment provided for this project.

B. Published literature shall be specifically oriented to the provided equipment indicating required operation and maintenance procedures, parts lists, assembly/disassembly diagrams, and related information.

C. The contractor shall incorporate the standard technical literature into system specific formats for this facility as designed and as actually installed. The resulting O&M information shall be project and system specific, concise, to the point, and tailored specifically to this facility.

D. The O&M manual review, and coordination efforts MUST be completed prior to Owner training sessions, as these documents are to be utilized in the training sessions.

E. In addition to the O&M manual requirements within other specification sections the O&M manuals shall include at a minimum the following:
   1. An equipment data sheet with the equipment name tag, model#, serial # and any other relevant information for the equipment for entry into the Owner's central maintenance management system (CMMS).
      a. The format of the data entry sheets will be provided by the owner and/or CxP.
      b. Data entry of the equipment information into the CMMS will be the responsibility of the owner.
   2. A copy of the approved submittal, indicating the exact make and model of the equipment installed.
   3. A copy of the manufacturer's IOM manual.
   4. A copy of all warranties.

3.13 TRAINING

A. Scheduling:
   1. Provide a proposed schedule and outline of training of Owner's personnel for CxP review approximately 30 days before project completion.
   2. Submit revised outline and fully developed training materials for review by CxP, 10 business days prior to scheduled training sessions.
   3. Organize training to fit Owner's schedule and to optimize the learning experience. Limit continuous sessions to no more than three hours at a time.
   4. All training eents shall be video recorded and provided to the GC for closeout turnover.

B. Training Materials:
   1. Develop Training Manuals to meet requirements of individual equipment specification sections.
   2. Operating and Maintenance Manuals alone are NOT considered training manuals. O&M Manuals may be used as reference but shall not be considered to meet requirements for training materials.
   3. Develop a detailed outline showing how training program will be organized, including classroom and hands-on training as required by individual specifications sections.
   4. Provide with training materials, a quick reference "how-to" index which will allow operators to easily access information included in Training Manuals and/or O&M Manuals. This reference will include, as a minimum, routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions.
   5. Refer to individual equipment or system specifications for minimum material to be covered as part of the training program.

3.14 SYSTEMS TO BE COMMISSIONED

A. GENERAL:
   1. The following outline of commissioning requirements by Division is provided as a guideline for Contractor, sub-contractors, and CxP to understand the nature and extent of commissioning work, so that resources may be properly allocated.
   2. Commissioning specifications supplement requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   3. For all sections listed below, Contractor and Subcontractors shall comply with all commissioning requirements specified.
   4. Although listed separately, systems listed below shall be commissioned as a part of another system, as determined by the CxP.

B. APPLICABLE SYSTEMS
   1. Division 07 - Thermal and Moisture Protection:
      a. For a list of Commissioned Systems, refer to Section 07 08 00.
   2. Division 08 - Openings:
      a. For a list of Commissioned Systems, refer to Section 08 08 00.
   3. Division 11 - Equipment:
      a. For a list of Commissioned Systems, refer to Section 11 08 00.
   4. Division 13 - Special Construction:
      a. For a list of Commissioned Systems, refer to Section 13 08 00.
   5. Division 14 - Conveying Systems:
      a. For a list of Commissioned Systems, refer to Section 14 08 00.
   6. Division 21 - Fire Suppression Systems:
      a. For a list of Commissioned Systems, refer to Section 21 08 00.
   7. Division 22 - Plumbing Systems:
      a. For a list of Commissioned Systems, refer to Section 22 08 00.
   8. Division 23 - Mechanical Systems:
      a. For a list of Commissioned Systems, refer to Section 23 08 00.
   9. Division 25 - Integrated Automation:
      a. For a list of Commissioned Systems, refer to Section 25 08 00.
   10. Division 26 - Electrical Systems:
      a. For a list of Commissioned Systems, refer to Section 26 08 00.
   11. Division 27 - Communications Systems:
      a. For a list of Commissioned Systems, refer to Section 27 08 00.
   12. Division 28 - Safety and Security Systems:
      a. For a list of Commissioned Systems, refer to Section 28 08 00.
   13. Division 33 - Utilities:
      a. For a list of Commissioned Systems, refer to Section 33 08 00.

3.15 EXCLUSIONS

A. Responsibility for construction means and methods: The CxP is not responsible for construction means, methods, job safety, or any construction management functions on the job site.

B. Hands-on work by the CxP: The contractors shall provide all services requiring tools or the use of tools to start-up, test, adjust, or otherwise bring equipment and systems into a fully operational state. The CxP shall coordinate and observe these procedures (and may make minor adjustments), but shall not perform construction or technician services other than verification of testing, adjusting, balancing, and control functions.

3.16 ATTACHMENTS

COMMISSIONING PLAN

END OF SECTION

SECTION 03 00 10
DIVISION 3 TABLE OF CONTENTS

1.01 DIVISION 03 – CONCRETE

03 20 00 - Concrete Reinforcement

03 30 00 - Cast-in-Place Concrete

03 45 00 - Precast Architectural Concrete

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing bars, welded wire reinforcement and supplementary or miscellaneous items, and devices incidental to general use of reinforcing steel for concrete.

B. Testing of reinforcing steel welding shall be performed by Owner's testing agency at Owner's expense.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. CRSI (DA4) Concrete Reinforcing Steel Institute; Manual of Standard Practice.

B. ACI 301 American Concrete Institute; Specifications for Structural Concrete.

C. ACI SP-66 American Concrete Institute; Detailing Manual.

D. ASTM A36/A36M Standard Specification for Carbon Structural Steel.

E. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

F. ASTM A663A/A663M Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.

G. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

H. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire.

I. ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete.

J. AWS D1.4/D1.4M American Welding Society. Structural Welding Code - Reinforcing Steel

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and CRSI Documents 63 and 65.

C. Conform to ACI 301 and ACI SP- 66.

1.05 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00 - Submittals:

1. Shop Drawings: Provide a placing plan indicating applicable details. Indicate sizes, spacing, location and quantities of reinforcing steel, bending and cutting schedules, splicing locations and lap lengths, stirrup spacing, supporting and spacing devices and placing tolerances.
    a. Shop drawings shall contain sufficient information to properly place all reinforcement.
    b. Any changes or deviations from the contract documents shall be clouded and clearly identified on the shop drawings.
    c. Clearly indicate if the shop drawings are being performed in phases and identify any items not included.

d. Slab-on-grade and slab-on-metal deck reinforcing shop drawings shall be submitted concurrently with related control/construction joint plans. See specification section 03 30 00 Cast-in-Place Concrete for additional information.

2. Procurement:
   a. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   b. Submit inventory to Owner within 5 days of delivery of materials.
   c. See Sections 01 33 00 and 01 60 00.

B. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel:
   1. ASTM A615/A615M, 60 ksi yield grade billet-steel and deformed bars, uncoated finish.
   2. ASTM A706/A706M, 60 ksi yield; deformed bars, uncoated finish.

B. Smooth Bar Dowels: ASTM A663/A663M, grade 60, round.

C. Slab on Ground Plate Dowels: Plate material shall be ASTM A36 steel and shall be Diamond Dowel System, by PNA Construction Technologies, size 1/4” x 4½ ” dowels. Locate plate dowels at construction joints. Do not shear plates. Remove burrs at edges of plates.

D. Contraction Joint Protection: Load plate shall be smooth steel plate bars, ASTM A36, and shall be Load Plate Basket or PD3 Basket by PNA Construction Technologies. Locate Load Plate Baskets at contraction joints so noted on the plans. Do not shear. Remove burrs.

E. Welded Steel Wire Fabric: ASTM A1064/A1064M plain type.

F. Steel Wire: ASTM A1064/A1064M, plain, cold drawn steel.

G. Welded Reinforcing: ASTM A706/A706M.

H. Monofilament, self-fibrillating, structural fibers meeting ASTM C1116/C1116M. See Specification Section 03 30 00 Cast-In-Place Concrete for more information.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Conform to CRSI recommendations.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and spaced for strength and support of reinforcement during installation and placement of concrete; including load bearing pad on bottom to prevent vapor barrier puncture.

C. Chairs, Bolsters, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces: Plastic coated or stainless steel type; sized and shaped as required.

2.03 FABRICATION

A. Fabricate in accordance with ACI SP-66, providing concrete cover specified in Section 03 30 00 - Cast-in-Place Concrete.

B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on Shop Drawings.

C. Weld reinforcing bars per AWS D1.4/D1.4M.

PART 3 EXECUTION

3.01 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles or coatings.

B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

C. Do not displace or damage vapor barrier required by Section 03 30 00 - Cast-in-Place Concrete.

D. Place reinforcement to obtain minimum coverages for concrete protection as specified in Section 03 30 00 - Cast-in-Place Concrete.

E. Install welded steel wire fabric in as long lengths as practicable. Lap adjoining pieces at least two full square and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. Mesh shall be chaired in place prior to pour.

3.02 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Special Structural Testing and Inspection Services: Structural Testing and Inspection shall be performed by qualified parties as specified herein. Include items required by the Currently adopted IBC Section 1705.3 and per Section 01 45 33, and other items which in professional judgment of Structural Engineer of Record, are critical to integrity of building structure.

C. Reinforcing Placement: A special inspector shall inspect placement of reinforcing for all concrete work scheduled for reinforcing prior to concrete placement.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formwork, shoring, bracing, anchorage, inserts, embedded items, and openings.
   2. Form accessories.
   3. Drain tile.
   4. Perimeter Foundation Insulation.
   5. Cast-in-place concrete.
   6. Stripping forms.
   7. Concrete curing materials and methods.
   8. Concrete sealer and slip-resistant finish coatings.
   9. Accessories.

1.02 SYSTEM DESCRIPTION

A. Formwork: Design, engineer and construct formwork, shoring and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions; and that formwork is able to support vertical and lateral loads until such loads can be supported by concrete structure.

1.03 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements.

E. Section 01 84 21 - Interior Concrete Floor Finishing Performance Requirements.

F. Section 03 20 00 - Concrete Reinforcement.

G. Section 05 31 00 - Steel Decking.

H. Section 05 51 00 - Metal Stairs.

I. Section 07 14 50 - Fluid Applied Waterproofing Membrane.

J. Section 07 27 26 - Fluid Applied Membrane Air Barriers.

K. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.

L. Section 09 05 61 - Common Work Results for Flooring Preparation.

M. Section 13 48 13 - Manufactured Sound and Vibration Control Components.

N. Section 32 13 13 - Concrete Paving.

1.04 REFERENCE STANDARDS

A. AASHTO M182 Standard Specification for burlap.

B. AASHTO T318 Standard Method of Test for Water Content of Freshly Mixed Concrete.

C. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

D. ACI 207.1 - Guide to Mass Concrete

E. ACI 301-20 American Concrete Institute; Specifications for Concrete Construction.

F. ACI 305 - Hot Weather Concreting.

G. ACI 306.1 - Standard Specification for Cold Weather Concreting.

H. ACI 308.1 - Standard Specification for Curing Concrete.

I. ACI 318-19 (22) American Concrete Institute; Building Code Requirements for Structural Concrete and Commentary.

J. ACI 347 - Guide to Formwork for Concrete.

K. ADAAG Americans with Disabilites Act Accessibility Guidelines.ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

L. ASTM C33/C33M Standard Specification for Concrete Aggregates.

M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

N. ASTM C42/C42M Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

O. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete.

P. ASTM C138/C138M Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

Q. ASTM C143/143M Standard Test Method for Slump of Hydraulic-Cement Concrete.

R. ASTM C150/C150M Standard Specification for Portland Cement.

S. ASTM C157/C157M Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.

T. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.

U. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

V. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

W. ASTM C231/C231M Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

X. ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete.

Y. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

Z. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

AA. ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete.

BB. ASTM C595/595M Standard Specification for Blended Hydraulic Cements

CC. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

DD. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.

EE. ASTM C881/C881M Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

FF. ASTM C989/C989M Standard Specification for Slag Cement for Use in Concrete and Mortars.

GG. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

HH. ASTM C1107/C1107M Standard Specification for Packaged Dry, Hydraulic-Cement Grout.

II. ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete.

JJ. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.

KK. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.

LL. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

MM. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

NN. ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

OO. ASTM D2047 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

PP. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

QQ. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

RR. ASTM E1155 Standard Test Method for Determining F(F) Floor Flatness and F(L).

SS. ASTM E1643 Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

TT. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. See Section 01 84 21 for additional quality requirements for concrete floors and floor substrates.

C. Maintain copy of ACI 301 on site.

D. Employ an independent testing laboratory to test proposed aggregate and design concrete mixes for each type of concrete required.

E. Design concrete mix proportions on basis of field experience and/or trial mix design in accordance with ACI 301. If historical data is used, accompany mix designs with complete standard deviation analysis.

F. Cast-In-Place Concrete: Obtain materials from the same source throughout the Work.

G. Formwork: Design, engineer and construct formwork, shoring and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions; and that formwork is able to support vertical and lateral loads until such loads can be supported by concrete structure.

H. Pre-Concrete Conference:
   1. This Pre-Concrete Conference is mandatory and no concrete work on building structure may commence until all conference criteria have been met to the satisfaction of the Design Team.
   2. At least 35 days prior to the start of the concrete construction schedule, the contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference. The following shall be in attendance:
      a. Concrete supplier.
      b. Concrete Sub Contractor.
      c. Independent Testing Laboratory.
      d. Admixture supplier.
      e. Architect.
      f. Construction Manager.
   3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner's representative, Consultant engineer.
   4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design, and placing, finishing and curing procedures can produce the concrete quality required by these specifications.
   5. A minimum of a 4 cubic yard trial mixture containing all required admixtures shall be placed at the job site using the accepted methods of placing, finishing and curing. This shall occur at least one week before actual concreting operations with the particular admixtures begin.

6. Architectural Concrete: Using same personnel, materials, equipment and construction techniques as will be used for final work, construct mock-up at least 8 feet wide and full height of the member, showing each surface treatment and joint construction methods proposed for use in the project. Mock-up drawings shall be submitted and approved prior to construction of mock up. Self-consolidating concrete shall be used and the proposed mix design shall be verified by a successful test placement onsite verifying proper workability, pumpability, setting time, and finish.
7. The Architect and Structural Engineer of Record shall have the option to be present at the conference.
8. The Contractor shall notify the Design Team at least 10 working days prior to the scheduled date of the conference.

I. Penetrating Hardener/Densifier Installer Qualifications:
1. Minimum of 15 concrete finish applications within last 3 years similar in type and size to Work of this Contract.
2. Assign experienced mechanics from previous applications including lead mechanic.
3. Provide letter of certification from the penetrating hardener/densifier manufacturer stating that installer is a certified applicator of the specified concrete finish material and is familiar with proper procedures and installation requirements required by manufacturer.

J. Concrete Floor Finish Applicator: Company specializing in concrete floor surface finishing with three years experience.

K. Concrete Floor Finishing: Furnish finishing materials in manufacturer's packaging with application instructions.
1. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

L. Waterstops: Samples of material, splicing details, and manufacturer’s literature indicating conformance with these Specifications for each type indicated.

M. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials.”
2. ACI 301, "Specification for Structural Concrete,"
3. ACI 302 “Guide for Concrete Floor and Slab Construction”.
4. ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”.
5. ACI 308 “Standard practice for Curing Concrete”.
6. ACI 309 “Standard Practice for Consolidation of Concrete”.
7. ACI 311 “Recommended Practice for Concrete Inspection”.
8. ACI 318, “Building Code Requirements for Structural Concrete.”

N. Conform to ACI 305 when concreting during hot weather.

O. Conform to ACI 306.1 when concreting during cold weather.

1.06 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00:
1. Mix Design: Indicate proposed mix design of each class of concrete to Architect/Engineer review 21 days prior to commencement of work. Do not begin concrete production until mixes have been reviewed and accepted by Architect/Engineer.
a. Include mix design types indicating location and placement of each mix class.
b. Submit proportions of ingredients for each mix class.
c. Submit aggregate gradation analysis showing compliance with ASTM C33.
d. Submit cement and supplemental cementitious material brand and type, slump, water/cement ratio, and strength test reports for 7 and 28 day strengths.
1) Submit product certifications for cement and/or blended hydraulic cements showing compliance with ASTM C150 and/or ASTM C595.

2) Submit product certifications indicating compliance with ASTM C618 for fly ash and ASTM C989/C989M for Ground Granulated Blast Furnace Slag if used.

e. Submittal shall show aggregate compliance with applicable fire rating UL assembly as indicated on architectural drawings.

f. Submit signed certifications stating compliance with ACI 318 requirements for each mix design.

g. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data indicating compliance with ACI 301. Submitted data shall be within the last 24-month period.

2. Certification of compliance for each material furnished stating that material conforms to acceptable ASTM standards.

3. Proprietary materials and items including forming accessories, admixtures, patching compounds, joint systems, curing compounds, and dry-shake finish materials. Indicate product conformation to applicable specifications. Submit manufacturer's literature.

4. If Contractor proposes to use curing compound(s) in lieu of the preferred specified wet cure process, then Contractor shall submit concrete curing compound product data sheets (for approval) and a concrete finishing schedule (for information only) including the following:
   a. Curing compound manufacturer certifications that their proposed products are approved for use with the applicable project waterproofing manufacturers (for information only).
   b. Curing compound manufacturer certifications that their proposed products are approved for use with the applicable project floor finishes (for information only).
   c. Floor finish manufacturer approvals of the curing compounds proposed for use under their floor finish (for information only).
   d. Show on floor plan where curing compounds are proposed for use, and what floor finishes are to be applied at those locations (for information only).
   e. If Contractor chooses to use curing compounds that are not compatible with the associated floor finishes, submit proposed methods of removal of curing compounds and approval(s) by associated floor finish manufacturer(s) (for information only).
   f. Manufacturer coverage requirements (square feet per gallon) for each application (horizontal, vertical) and final finish type (troweled, broom, float, rough).

5. Contractor shall submit slab on grade and slab on insulation control and construction joint layout plan, as applicable, for review three weeks minimum prior to slab pour.
   a. The plan shall be coordinated by the Contractor with the architectural floor plan, structural floor plan and related structural details to locate joints beneath walls and fixtures, when possible.

6. Contractor shall submit composite slab construction joint layout plan for review three weeks minimum prior to slab pour.
   a. See structural drawings for guidelines on suggested construction joint locations.

7. Submit waterstop product information with corresponding joint locations identified.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

C. Quality Control Submittals: Submit the following under provisions of Section 01 40 00:
   1. Concrete Delivery Tickets: Indicate quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump and time of batching for each load delivered.
   2. Test Reports: Indicate project identification name and number, concrete placement date, testing service name, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

PART 2 PRODUCTS

2.01 GENERAL

A. Comply with recommendations of ADAAG for slip resistance using ASTM D2047 as follows:
   1. Accessible Routes (as defined by ADAAG): 0.6 static coefficient of friction.
   2. Ramps (as defined by ADAAG): 0.8 static coefficient of friction.

2.02 FORM MATERIALS

A. Conform to ACI 301 and ACI 347

B. Void Forms: Moisture resistant treated paper faces; biodegradable; structurally sufficient to support weight of wet concrete until initial set; Thickness to exceed expected potential movement of soil and/or concrete.
   1. Acceptable suppliers
      a. SureVoid by VoidForm
      b. Approved substitution

C. Compressible Material: Closed-cell Polyethylene Foam meeting the requirements of ASTM D3575-20 Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
   1. Maximum compressive strength of 7 psi at 25% deformation
   2. Acceptable suppliers
      a. Ethafoam
      b. Approved substitution

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off metal of adjustable length; 1-1/2" break back dimension; free of defects that will leave holes no larger than 1" diameter in concrete surface.

B. Form Release Agent: Proprietary mix, colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
   1. Products;
      a. FormShield Pure or Formshield WB by The Euclid Chemical Co
      b. Or approved substitution.

C. Fillets for Chamfered Corners: 3/4" x 3/4", wood, rigid plastic, metal or rubber type; maximum possible lengths; fabricated to produce uniform smooth lines and tight edge joints.

D. Nails, Spikes, Lag Bolts, Through Bolts and Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

E. Below Grade Pipe Sleeves: ASTM A53, schedule 40, galvanized.

2.04 CONCRETE MATERIALS

A. Portland cement:
   1. ASTM C150, Type I or II & Type V as indicated ASTM C 1157, Type GU or LH Single brand and type of cement.
   2. High early strength option for footings and site cast concrete wall panels:
      a. ASTM C150, Type III High Early Strength, ASTM C1157, Type HE. Type III Portland cement may be used to produce high early strength concrete.
      b. Adding additional amounts of Type I Portland cement to produce high early strength concrete will not be permitted.
   3. ASTM C595. Blended Hydraulic Cement (Type IS and IT are excluded)

B. Supplementary Cementitious Materials:
   1. Fly Ash ASTM C618, Type C or F
   2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120
   3. The exact percentages of supplementary cementitious materials used shall be based on a successful test placement on-site.

C. Fine and Coarse Aggregates: ASTM C33, Class 3S.
   1. Provide aggregates from a single source for exposed aggregates.

2. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
3. Lightweight Concrete: Expanded Shale, Clay, or Slate (ESCS) lightweight aggregate produced by the rotary kiln method shall meet ASTM C330/C330M. Obtain from source with uniform density.
4. Minimum total coarse aggregate content of 12 cubic feet for 1 ½" or larger top size aggregate; 11.5 cubic feet for top size aggregate 1 ¼" or larger but less than 1 ½"; 11 cubic feet for topsize aggregate 1" or larger but less than 1 ¼"; or 10.5 cubic feet for topsize aggregate less than 1".

D. Water: Potable.

2.05 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce maximum mixing and delivery time to 60 minutes.

D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, HRWR may be redosed at the site as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer and the manufacturer at the Pre-Concrete Conference.

E. No water is to be added on-site unless:
1. Total water does not exceed maximum w/cm specified
2. Water is added at direction of ready-mix supplier
3. Water addition is documented on delivery ticket.

2.06 PROPORTIONING AND DESIGN OF MIXES

A. Preparation of Design Mixes:
1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318. Submit mix designs on each class of concrete for review.
2. If field experience based mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1400 psi when concrete strengths of 5000 or more are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.
5. The testing facility shall not be the same as used for field quality control testing.
6. Supplemental Cementitious Materials
   a. Limit use of fly ash to not exceed 25 percent of cementitious content by weight, unless specifically noted otherwise.
   b. Limit use of slag to not exceed 50 percent of cementitious content by weight.
   c. Combined fly ash and slag shall not exceed 50 percent by weight with fly ash not exceeding 25 percent by weight, unless specifically noted otherwise.
   d. In concrete greater than 3 foot 6 inches thick, the maximum usage rate may be 33% for fly ash and 50% for slag individually or 66% combined.
   e. Do not use flyash in exterior concrete.
   f. The exact percentages used shall be based on a successful test placement on-site.

7. Proportion concrete mix designs appropriately to reach the required design strength and other properties noted and to be appropriate for their intended use. Use concrete admixtures in accordance with ASTM C494. Use air-entraining admixtures in accordance with ASTM C260

B. Concrete Mixes:
   1. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules below:
   2. **Class A**: Interior Slab-on-Grade: Proportion normal-weight concrete mixture as follows:
      a. Design Compressive Strength: 3000 psi minimum at 28 days.
      b. Exposure Class in accordance with ACI 318: F0, S0, W1, C1
      c. Cement Type: ASTM C150 Type I, Type II, or ASTM C595 TYPE IL
      d. Concrete Density: Normal weight 150 pcf max
      e. Maximum Water-Cementitious Materials Ratio: 0.50
      f. Macro Fiber at a minimum dosage of 3.0 pounds per cubic yard (see related section below).
      g. Maximum Aggregate Size: 1 1/2".
   3. **Class B**: Exterior Slabs, Stoops, Pool Aprons: Proportion normal-weight concrete mixture as follows:
      a. Minimum Compressive Strength: 5000 psi at 28 days.
      b. Exposure Class in accordance with ACI 318: F3, S0, W1, C2
      c. Cement Type: ASTM C150 Type I, Type II, or ASTM C595 TYPE IL
      d. Concrete Density: Normal weight 150 pcf max
      e. Maximum Water-Cementitious Materials Ratio: 0.40
      f. Air Content: As required by ACI 318 for exposure class.
      g. Maximum Aggregate Size: 1"
   4. **Class C**: Footings, Piers, Foundation Walls, Elevator pits: Proportion normal-weight concrete mixture as follows:
      a. Minimum Compressive Strength:
         1) 4000 psi at 28 days for F0 exposure.
         2) 4500 psi at 28 days for F2 exposure.
      b. Exposure Class in accordance with ACI 318: S0, W1, C1
         1) F0 if element is not exposed to freezing and/or is entirely below frost depth
         2) F2 if element is exposed to freezing and/or is entirely or partially above frost depth.
      c. Cement Type: ASTM C150 Type I, Type II, Type III, or ASTM C595 TYPE IL
      d. Concrete Density: Normal weight 150 pcf max
      e. Maximum Water-Cementitious Materials Ratio: 0.45
      f. Air Content: As required by ACI 318 for exposure class.
      g. Maximum Aggregate Size: 1 ½".
   5. **Class D**: Composite Floor Slabs on Deck, Isolation Slabs: Proportion normal-weight concrete mixture as follows:
      a. Minimum Compressive Strength: 4000 psi at 28 days.
      b. Exposure Class in accordance with ACI 318: F0, S0, W0, C0
      c. Cement Type: ASTM C150 Type I, Type II, or ASTM C595 TYPE IL
      d. Concrete Density: Normal weight 150 pcf max
      e. Maximum Water-Cementitious Materials Ratio: 0.45
      f. Slump Limit: 3-5 inches
      g. Air Content: None required.
      h. Maximum Aggregate Size: ¾".
      i. Aggregate type shall comply with applicable fire rating UL assembly as indicated on Architectural drawings.
   6. **Class E**: Interior water retaining vessels: Proportion normal-weight concrete mixture as follows:
      a. Minimum Compressive Strength: 5000 psi at 28 days.
      b. Exposure Class in accordance with ACI 318: F0, S1, W2, C2
      c. Cement Type: ASTM C150 Type I, Type II, or ASTM C595 TYPE IL
      d. Concrete Density: Normal weight 150 pcf max

e. Maximum Water-Cementitious Materials Ratio: 0.40
f. Air Content: As required by ACI 318 for exposure class.
g. Maximum Aggregate Size: ¾".

7. **Class F**: Mat Footings, greater than 3'-6" thick: Proportion normal-weight concrete mixture as follows:
   a. Minimum Compressive Strength: 4500 psi at 28 days
   b. Exposure Class in accordance with ACI 318: F2, S0, W1, C1
   c. Cement Type: ASTM C150 Type I, Type II
      1) Mix shall be proportioned according to one of the following:
         (a) 50% minimum slag
         (b) 33% slag, 33% flyash and 34% Type I or II cement
   d. Concrete Density: Normal weight 150 pcf max
   e. Maximum Water-Cementitious Materials Ratio: 0.45
   f. Air Content: As required by ACI 318 for exposure class.
   g. Maximum Aggregate Size: 1 ½".
8. **Class G**: Interior Concrete 2" or less in thickness including Stair Pans: Proportion normal-weight concrete mixture as follows:
   a. Minimum Compressive Strength: 3000 psi at 28 days.
   b. Exposure Class in accordance with ACI 318: F0, S0, W0, C0
   c. Cement Type: ASTM C150 Type I, Type II, or ASTM C595 TYPE IL
   d. Concrete Density: Normal weight 150 pcf max.
   e. Maximum Water-Cementitious Materials Ratio: 0.50
   f. Slump Limit: 3-5 inches.
   g. Air Content: None required.
   h. Maximum Aggregate Size: 3/8".

C. Macro Fiber for Class A: Slab-on-grade: Concrete slabs where indicated shall contain specified Structural Synthetic Macro Fiber at a dosage rate as indicated on drawings. Fibers may be added at plant location or job-site and shall be mixed in concrete for a minimum of 4 minutes.

D. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, minimum 1-1/2 inches (51 mm) long, average minimum equivalent residual strength (f_{e3}) of 150 psi when tested at a dosage rate of 4.0 pounds per cubic yard in accordance with ASTM C1609.
   1. Synthetic macrofiber shall be tested in concrete to meet the requirements of ICC-AC383.
   2. Fiber must provide minimum plastic shrinkage crack reduction of 86 percent when tested in accordance with ASTM C1579.
   3. Synthetic macrofiber in fire rated assemblies to be UL-certified for 2-hour minimum fire-resistance-rated construction when used in lieu of welded wire fabric in UL Design Series D700, D800, and D900 Floor-Ceiling Assemblies.
   4. Products: Subject to compliance with requirements, provide one of the following:
      a. Euclid Chemical Company (The), an RPM company: Tuf-Strand SF.
      b. FORTA Corporation: FORTA FERRO.
      c. Grace Construction Products, W. R. Grace & Co.: Strux 90/40.
      d. Nycon, Inc.: XL.
      e. Sika Corporation: SikaFiber Force-650, Fibermesh-650.
      f. BASF: MasterFiber MAC100

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.07 ADMIXTURES

A. Admixtures:

1. Use water-reducing admixture or high range water-reducing admixture (Superplasticizer) in all concrete as required for placement and workability.
2. Accelerating: Use the specified non-corrosive, non-chloride containing accelerator in all concrete, less than 8 inches in thickness, placed at air temperature below 50 degrees F.
3. Use high-range water-reducing admixture in pumped concrete, architectural concrete, concrete required to be watertight, self-consolidating concrete, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
4. All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 5% to 7.5% or as required by ACI 318 for the exposure class.
5. Integral finishing admixture may be used to reduce concrete bleeding, segregation and rapid moisture loss from surface. Do not use in concrete to receive dry shake hardeners.
6. Use shrinkage-reducing and/or shrinkage-compensating admixtures in concrete mixtures as required to achieve maximum allowable shrinkage when specified.
7. Use permeability-reducing admixture in concrete mixtures where indicated.

B. Shrinkage Compensating Admixture:
   1. Conex by The Euclid Chemical Company.

C. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.05 percent chloride ions and as required by ACI 318 for the exposure class are not permitted.

D. Air Entraining Admixture: Comply with ASTM C260, and be certified by the manufacturer to be compatible with other admixtures to be used.
   1. Acceptable Manufacturers/Products:
      a. Euclid Chemical Company – Air Mix, Air Max or AEA Series.
      b. Chryso - Darex or Daravair series.
      c. Master Builders - MB-VR or MB-AE

E. Water-Reducing Admixture: Conform to ASTM C494, Type A, and compatible with other admixtures in the same mix design.
   1. Acceptable Manufacturers/Products:
      a. Euclid Chemical Company, Eucon MR Series, Eucon X Series or Plastol Series.
      b. BASF, Pozzolith Series.
      c. WR Grace, WRDA Hycol.

F. Water-Reducing, Retarding Admixture: Conform to ASTM C494, Type D and not more than 0.05 percent chloride ions and as required by ACI 318 for the exposure class.
   1. Acceptable Manufacturers/Products:
      a. Euclid Chemical Company, Eucon Retarder-75 or Eucon DS.
      b. BASF, Pozzolith 100XR.
      c. Sika Corporation, Plastocrete 10N
      d. WR Grace, DaratardSeries.
   2. Compatible with other admixtures in the same mix design.

G. High-Range Water-Reducing Admixture: Conform to ASM C494, Type F or Type G and containing not more than 0.05 percent chloride ions and as required by ACI 318 for the exposure class.
   1. Acceptable Manufacturers/Products:
      a. Euclid Chemical Company, Eucon 37, 537 or Plastol Series
      b. BASF, Rheobuild 1000 or Glenium Series.
      c. WR Grace, Daracem or Adva series.
   2. Compatible with other admixtures in the same mix design.

H. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
   1. Acceptable Manufacturers/Products:
      a. Euclid Chemical Company, Accelguard 80/90 or NCA.

b. Conform to ASTM C494, Type C or E.
2. Compatible with other admixtures in the same mix design.

I. Crystalline Waterproofing Admixture: Integral crystalline admixture specifically formulated to interact with capillary pore structures to provide a waterproofing system that is a permanent part of the concrete matrix. Admixture shall provide the following properties:

1. Water Penetration per DIN 1048	40% Reduction at 72 psi.
2. Water Permeability per CRD C48-92	>70% Reduction at 200 psi
3. Capillary Absorption per ASTM C-1585	>40% Reduction
4. Compressive Strength per ASTM C-39	Equal to and up to 8% increase
5. Resistance to Chloride Penetration per ASTM C-1202	10% improvement

6. Basis of Design Product:
   a. Euclid Chemical Company (The); Vandex AM-10 or Vandex AM10L,

2.08 CURING MATERIALS

A. Water: Clean and not detrimental to concrete or steel. Potable or complying with ASTM C1602/C1602M.

B. Evaporation Retarder:
1. Manufacturers/Products: Subject to compliance with requirements, provide by one of the following:
   a. "Eucobar", Euclid Chemical Co.
   b. "MasterKure ER 50", BASF

C. Moisture Cover Type:
1. Absorbent Covers: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry. These materials must be free of harmful substances, such as sugar or fertilizer, or substances that may discolor the concrete. To remove soluble substances, burlap should be thoroughly rinsed in water before placing it on the concrete.
2. Moisture Retaining Covers:
   a. Plastic Film: ASTM C171, 10 mil minimum thickness polyethylene film
   b. White burlap-polyethylene sheet meeting ASTM C171
   c. Reinforced Curing Paper: Complying with ASTM C171
   d. Moisture Retaining Fabric: Conforming to ASTM C171: A naturally colored, non-woven polypropylene fabric with a 4-mil non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.
   e. Acceptable Manufactures/Products;
      1) PNA Construction Technologies, Inc.; HydracureS16.
      2) Reef Industries Incorporated; Transguard 4000.

D. Curing Compounds:
1. See submittals sections for additional submittal requirements if the Contractor proposes the use of curing compounds.
2. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB
      2) ChemMasters, Inc.; Safe-Cure Clear
      3) Dayton Superior Corporation; Clear Resin Cure J11W
      4) Euclid Chemical Company (The); an RPM company; Kurez DR VOX or Kurez DR 100
      5) Kaufman Products, Inc.; Thinfilm 420
      6) Lambert Corporation; Aqua Kure-Clear
      7) Nox-Crete Products Group; Res-Cure DH 100
      8) Vexcon Chemicals Inc.; Certi-Vex Envio Cure 100

9) W.R. Meadows, Inc.; 1150 Clear
10) L&M: L&M Cure R
11) SpecChem: SpecRez

2.09 SEALANTS

A. Sealant and Primer: Specified in Section 07 92 00.

2.10 FINISHING MATERIALS

A. Liquid Sealer Densifier: The liquid densifier compound shall be a siliconate based sealer which penetrates concrete surfaces, and provides a "low-sheen" surface that is easy to clean and eases the problem of tire mark removal. The compound must contain a minimum solids content of 20% of which 50% is siliconate.
   1. Manufacturers/Products: Subject to compliance with requirements, provide one of the following:
      a. "Euco Diamond Hard", The Euclid Chemical Co.
      b. Or approved substitution.

2.11 INTEGRAL JOINT MATERIALS

A. Formed Construction Joints: Tongue groove type profile; knockout holes at 6" o.c. to receive doweling; with anchors.

B. Control Joint Insert: T-shaped plastic strip, 1/16" thick with 3/4" wide removable top and barbed bottom. Depth not less than 1/4 slab thickness. Similar to Greenstreak Plastic Products, "Zipcap Control Joint Former".

C. Joint Filler (bond breaker): ASTM D1751, 1/2" thick, pre-formed, resilient, non-extruding, asphalt impregnated, vegetable fiber and finely divided mineral filler.

D. Column Isolation Joint Filler: Plastic circular type, designed to lock shut around columns, full slab thickness.

E. Waterstops:
   1. PVC waterstop.
      a. Provide flexible 100 percent virgin specification grade Polyvinyl Chloride (PVC) Waterstop, Sika Greenstreak, or equal.
      b. Resistance to hydrostatic head – 65 feet of water (moving or non-moving joints).
      c. Profile: Provide profile of type suitable for application and as follows.
         1) Moving joints, expansion, or contraction joints:
            (a) Rib with center bulb.
            (b) Provide in widths indicated in Drawings.
         2) The PVC waterstop shall be extruded from an elastomeric plastic material, of which the basic resin is prime, virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigments.
      d. Accessories.
         1) Provide factory fabricated waterstop connections for all changes of direction, intersections, and transitions leaving only butt joint splicing for the field.
         2) Provide hog rings, grommets or holes spaced at 12 inches on center along the length of the waterstop.
         3) Provide thermostatically controlled, Teflon covered waterstop splicing irons for field splicing.
   2. Strip waterstop.
      a. Resistance to hydrostatic head – 65 feet of water (non-moving joints).
      b. Henry SF302 Synko-Flex waterstop as manufactured by Henry Company, or equal.
         1) Non-swelling preformed joint sealant.
         2) Applicable for both fresh and cured concrete surfaces.
         3) Single component.
         4) Self-sealing adhesive compound.

2.12 ACCESSORIES

A. Vapor Barrier: Provide vapor barrier which conforms to ASTM E1745, Class A. The membrane shall have a water-vapor transmission rate no greater than 0.008 gr./ft2/hr when tested in accordance with ASTM E96. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 15 mil thick. Use only materials which are resistant to decay when tested in accordance with ASTM E154.
   1. Products Subject to compliance with requirements, provide one of the following:
      a. “Stego Wrap (15 mil) Vapor Barrier”: Stego Industries LLC
      b. "Pre-moulded Membrane with PLASMATIC CORE", W.R. Meadows.
      c. “Griffolyn Vaporguard” Reef Industries

B. Non-shrink Grout: Conforming to ASTM C1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink). Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 8000 psi in 28 days;
   1. Manufacturers/Products: Subject to compliance with requirements, provide one of the following:
      a. "Masterflow 713", Sika
      b. "Euco-NS', Euclid Chemical Co;
      c. "Five Star Grout," U.S. Grout Co;

C. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.
   1. Manufacturers/Products: Subject to compliance with requirements, provide the following:
      a. "EucoFloor SL160", The Euclid Chemical Co
      b. "Ardex K-40", Ardex Co.

D. Bonding Compound: Polyvinyl acetate, re-wettable type;
   1. Manufacturers/Products: Subject to compliance with requirements, provide the following:
      a. "Eucoweld 2.0", Euclid Chemical Co;
      b. "Daraweld C", Chryso;
      c. "Master Emaco", Sika

E. Epoxy Adhesive: ASTM C881, type V, two (2) components, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces.
   1. Manufacturers/Products: Subject to compliance with requirements, provide one of the following products, or acceptable product by listed Manufacturer:
      a. "Sikadur Hi-Mod", Sika Corp.
      b. "Dural 452", The Euclid Chemical Co.

F. High Strength Flowing Topping and Repair Mortar: For forming and pouring structural member repairs , or large horizontal repairs, provide the flowable one-part, high strength microsilica modified repair mortar with 3/8” aggregate. The product shall achieve 9000 psi at 28-days at a 9-inch slump.
   1. Manufacturers/Products: Subject to compliance with requirements, provide one of the following:
      a. “Eucocrete”: Euclid Chemical Co.

G. Polymer Patching Mortar: Polymer and microsilica modified cementitious based compounds.
   1. Manufacturers/Products: Subject to compliance with requirements, provide one of the following:
      a. Horizontal:
         1) "Thin Top Supreme”: Euclid Chemical Co.
         2) "Concrete Top Supreme", Euclid Chemical Co.
         3) "VersaSpeed LS100", Euclid Chemical Co.
         4) “Tammspatch II”: Euclid Chemical Co.
         5) “Emaco R300 CI”: Sika
         6) “Emaco R310 CI”: Sika
      b. Vertical/Overhead:
         1) "EucoRepair V100", Euclid Chemical Co.
         2) "Emaco N420 CI": Sika

H. Post-Installed Anchors: See Structural Drawings

I. Cast-In – Place Detectable/Tactile Warning Surfaces:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "The Vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Surface Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. (800-682-2525). Existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
      b. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the tile. Tiles are also available in Light Grey (Federal Color No. 26280), Dark Grey (Federal Color No. 36118), Onyx Black (Federal Color No. 17038), Pearl White (Federal Color No. 37875), Brick Red (Federal Color No. 22144).

PART 3 EXECUTION

3.01 COORDINATION

A. Ensure all work required to be in place, and furnished by other sections, is coordinated and correctly placed prior to concrete placement.

3.02 SCHEDULES

A. Formwork Schedule:
   1. Location: Form Finish Material
   2. Exposed: Smooth plywood, steel, gfr plastic.
   3. Unexposed Semi-smooth Lumber, plywood, steel, gfr plastic.

B. Curing Schedule:
   1. Moisture Retaining: Slabs on grade and structural slabs.
   2. Water Cure, Absorptive Mat, or Moisture Retaining: Other areas
   3. If Curing Compound used: All areas per manufacturer recommendations and following

C. Floor Slab Finish Schedule:
   1. Trowel: Exposed to view, thin-set tilework.
   2. Broom or Belt: Exterior platforms, sidewalks, steps, and ramps.
   3. Float: Full-bed-set tilework.
   4. Penetrating Sealer Hardener: Exposed interior, unfinished floor areas.
   5. Non-Slip

3.03 FORMWORK INSTALLATION

A. Formwork Inspection:
   1. Verify lines, elevations and measurements before proceeding with formwork.

B. Formwork Preparation:
   1. Earth forms not permitted
   2. Minimize form joints. Symmetrically align joints and make water tight to prevent leakage of mortar.
   3. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
   4. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

C. Formwork Erection:
   1. Construct formwork and camber beams and slabs to maintain tolerances in accordance with ACI 301.
   2. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be over stressed by construction loads.
   3. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

4. Provide chamfer strips on all exposed external corners.
5. Build-in sleeves, anchors, inserts, bolts and other devices indicated or required. Provide sleeves 1/2" larger in diameter than piping to be sleeved, unless otherwise indicated. Install sleeves flush with finished surfaces. Coordinate and build in sleeves, thimbles, and other items furnished or set in place by other sections.
6. Do not displace or damage vapor barrier.

D. Preparation of Form Surfaces:
1. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
2. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust stained steel formwork is not acceptable.
3. Do not apply form release agent where concrete surfaces are scheduled to receive rough wood texture or special finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

E. Formwork Inserts, Embedded Parts, and Openings:
1. Provide formed openings where required for work embedded in or passing through concrete.
2. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
3. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.
4. Verify lines, elevations and measurement before proceeding with formwork.

F. Formwork Cleaning:
1. Clean forms to remove foreign matter as erection proceeds.
2. Ensure that water and debris drain to exterior through clean-out ports.
3. During cold weather, remove ice and snow from forms. Do not use de-icing salts, calcium chloride or other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs. Do not use water to clean out completed forms, unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

G. Form Removal:
1. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.
2. Remove formwork progressively so no unbalanced loads are imposed on structure.
3. Do not damage concrete surfaces during form removal.
4. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
5. Exposed Concrete Surfaces:
    a. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.
    b. Clean surfaces of forms to be reused in Work.
    c. Split, frayed, delaminated, patched or damaged form facing material will not be acceptable for exposed surfaces.
    d. Apply new form coating compound as specified for new formwork.

3.04 VAPOR BARRIER INSTALLATION

A. Install vapor barrier above the sand base under interior slabs on grade. Lap joints minimum 6” and tape. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier. Vapor barrier installation must comply with the requirements of ASTM E1643-98.

3.05 CONCRETE MIXES

A. Submit proposed mix design of each class of concrete to testing laboratory for review prior to commencement of Work.

B. Mix concrete in accordance with ASTM C94 (Option C).

C. High Early Strength: Type III Portland cement may be used to produce high early strength concrete. Adding additional amounts of Type I Portland cement to produce high early strength concrete will not be permitted

3.06 CONCRETE PLACEMENT

A. Inspection:
   1. Verify formwork, anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.
   2. Verify all required inspections have been performed.
   3. The use of the LTF Construction POUR CARD is a requirement before pouring, and before payment is to be issued. This subcontractor must get this approval before pouring, without approval this subcontractor will bear all responsibility (of his work) for repair, demolition, delays and etc. This is a protection device initiated to eliminate mistakes by all parties involved prior to concrete placement.

B. Preparation:
   1. Thoroughly clean forms before placing concrete. Dampen masonry and porous earth in contact with concrete. Do not place concrete on water or frozen ground.
   2. Prepare previously placed concrete by cleaning with steel brush and thoroughly wet and slush with neat cement grout immediately before placing new concrete.

C. Placing Concrete:
   1. Place concrete as close as possible to final position. Prevent segregation. Place with maximum free drop of 5 feet. Compact during placing with internal vibrators (8000 vpm minimum). Work around reinforcement, embedded items and into form corners. Do not use vibrators to transport concrete within forms. Vibrators shall be used for slab-on-grade placements with focus on slab edge consolidation. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete".
   2. Place concrete within one hour after mix water has been added.
   3. Place concrete in accordance with ACI 301, and as follows:
   4. Cold Weather Placement:
      a. Conform with requirements of ACI 306R.
      b. Protect work from physical damage or reduced strength caused by frost, freezing, or low temperatures.
      c. If at 40 deg F or expected, uniformly heat aggregates and water before mixing, to obtain 50-80 deg F mixture temperature at point of placement.
      d. Do not use frozen materials or materials containing snow or ice, or place on frozen subgrade or subgrade containing frozen materials.
      e. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
   5. Hot Weather Placement:
      a. Conform with requirements of ACI 305R.
      b. Cool ingredients to maintain 90 deg F concrete temperatures at time of placement.
      c. Mixing water may be chilled, or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing.
      d. Cover reinforcing steel with water-soaked burlap, to ensure steel temperature will not exceed ambient air temperature immediately before embedment in concrete.
      e. Wet forms thoroughly before placing concrete.
      f. Use water-reducing retarding admixture (Type D) when required by high temperatures.
   6. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
   7. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect upon discovery.
   8. Maintain concrete cover around reinforcing as noted in ACI 318, Chapter 20 and as shown in the drawings/details.

9. Placing Composite Topping: Remove all Laitance and saturate surface with water. Remove all standing water.
10. Interior concrete slab-on-grade: A minimum of one (1) finisher or finishing supervisor shall be a certified ACI Flatwork Finisher/Technical and shall be present during all interior slab-on-grade placement operations.

D. Additional Composite Deck Requirements
1. The contractor shall be cognizant of allowable construction live loads (including personnel and equipment) and plan concrete placing operations accordingly so as to not overstress or damage the deck. The contractor shall verify with the deck manufacturer that the proposed concrete placing operation is compatible with the type, gauge, span, and length of the composite deck as furnished,
2. When placing concrete on metal deck, use of a ride-on laser screed is prohibited. Floors to be screeded from beams to a constant thickness, not to level within a bay. Deck is designed to handle wet weight of concrete plus 150 lb concentrated load per flute in one span of deck or non-concurrent 20 psf construction live load. See ANSI/SDI-C-1.0 for more information.
3. Confirm presence of qualified on-site inspection and concrete placement observation immediately prior to and during concrete placement.

3.07 TOLERANCES / MONOLITHIC SLAB FINISHES

A. Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units). All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the architect) shall be 2/3 of the specified tolerances. All elevated slabs shall achieve the specified FL tolerance after the removal of the forms.
1. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".
2. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".
3. All floors shall be measured in accordance with ASTM E1155 "Standard Test Method for levelness.

B. Screed exposed concrete floors and floors to receive resilient flooring, carpet, or thin-set ceramic and quarry tile to an even, level plane. Float and provide troweled finish in accordance with procedures in ACI 301, Chapter 11 and as recommended by ACI to achieve floor flatness and levelness specified. Uniformly slope to elevations shown on the Drawings to floor drains. The final troweling operation shall be free of trowel marks, uniform in texture and appearance. Grind smooth, surface defects, which would telegraph through applied floor system. Finished surfaces, other than rooms with floor drains, shall have floor flatness and levelness as determined in accordance with ASTM E1155 as indicated in the tables below.

C. Corrective measures, acceptable to the Architect, may be made to floor slabs scheduled to receive finish materials.

D. Corrective measures such as grinding, planning, surface repair or retopping will not be permitted for floor slabs scheduled for clear sealer/hardener finish.

E. In areas with floor drains, maintain floor level at walls. Slope surface uniformly to drains allowing a 1/2" recess at drain from approximately 4' x 4' around drain.

SLAB-ON-GRADE TOLERANCES TABLE

Occupancy	F_F (Flatness)	F_L (Levelness)	Gap
Non-critical areas such as mechanical rooms and surfaces to have thick set tile.	20	15	5/16"
Carpeted areas:	25	20	1/4"
Thin-set flooring:	35	25	1/8"

Resilient Tile flooring:	36	20	3/16"
Large format tile (as identified by TCNA), Tennis and Pickleball Surfaces.	50	25	1/8"

SUPPORTED FLOOR TOLERANCES TABLE

Occupancy:	F_F (Flatness)	F_L (Levelness)	Gap
Non-critical areas such as mechanical rooms and surfaces to have thick set tile:	20	-	5/16"
Carpeted areas:	25	-	1/4"
Thin-set flooring:	35	-	1/8"
Resilient Tile flooring	36		3/16"
Wood floors:	35	-	1/8"
Large format tile (as identified by TCNA):	50	-	1/8"

3.08 JOINT INSTALLATION

A. Locate and form expansion control and contraction joints to pattern as shown on Drawings.

B. Place formed construction joints in floor slab pattern placement sequence. Set top screed to required elevations. Secure to resist movement of wet concrete.

C. Install joint fillers and sealants in accordance with manufacturer's instructions. Use primers of type recommended by joint filler and sealant manufacturer.

D. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.

E. Construction Joints:
   1. Joints not shown on Drawings to be located so as not to impair strength or appearance of structure, as determined by Architect/Engineer.
   2. Provide key ways at least 1-1/2" deep in wall, and wall to footing construction joints.
   3. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints. Provide diamond dowels where directed.
   4. Roughen and thoroughly clean surface of concrete, remove laitance, and wet surface before placing new concrete against joint. Slush vertical joints with neat cement grout immediately before placing new concrete.
   5. Place construction joints in reinforced concrete only as indicated on reinforcing steel shop drawings.
   6. Contractor to submit composite slab construction joint layout plan for review and approval a minimum of three weeks prior to pour.

F. Control Joints:
   1. Locate control joints for interior slab-on-grade based on criteria shown on structural drawings.
      a. Contractor to submit control joint layout plan for review and approval a minimum of three weeks prior to pour.
   2. Slabs on Grade: Use joint inserts or saw cut.
      a. See plan for joint depth.
      b. Cut using a 1/16 to 1/8 inch (max.) thick blade. Cut a minimum 1/3 Depth of Concrete (d/3). Chalk lines and concrete dust shall be removed completely and immediately after cutting operation
      c. Early entry saw may be used immediately after concrete finishing when cutting action will not tear, ravel, abrade, or otherwise damage surface and before concrete develops random contraction cracks, to cut control joints to depth of D/3. Saw cutting shall proceed no more than 12-hours after concrete placement.

d. Place joint inserts in groove formed in concrete with metal straight edge.

3. Sidewalks: Score with finishing tool to 1/4 slab depth; 8 ft o.c. each way maximum, unless shown otherwise on Drawings.

G. Isolation Joints:
1. Provide isolation joints at interior slabs-retaining walls and columns, exterior slabs on fill to vertical surfaces.
2. Form joint with joint filler from bottom of slab to within 1/2" of finished slab surface.

H. Expansion Joints:
1. Locate where indicated on Drawings and where exterior slabs abut restraining walls. Do not run reinforcing through joints. Form joints with joint filler extending full depth of slab, unless otherwise indicated. Hold joint filler 3/8" below concrete surface.

3.09 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Special Structural Testing and Inspection Services: Perform Structural Testing and Inspection by qualified parties as specified herein and per Section 01 45 33. Include items required by the Currently adopted IBC Section 1705.3, the Drawings, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
1. Refer to the Structural Drawings for the Schedule of Special Inspections along with the information outlined below.

C. Provide free access to Work and cooperate with appointed firm.

D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

E. On a periodic basis, inspect formwork for shape, location and dimensions of concrete members being formed. Verify in-situ concrete strength prior to removal of shores and forms from beams and slabs.
1. Contractor’s formwork design engineer to inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, applicable code requirements and that supports, fastenings, wedges, ties, embedded items and all other items are secure.
2. Schedule concrete placement to permit formwork inspection before placing concrete.

F. Notify Architect/Engineer with sufficient time to allow Architect/Engineer to schedule a site visit after placement of reinforcing steel in forms, but prior to placing concrete.

G. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

H. Concrete Inspections:
1. Continuous Placement Inspection: Inspect for proper installation procedures and the following:
a. Batch tickets conform to approved mix designs.
b. Total water added to mix on site does not exceed that allowed by the mix design.
c. Concrete quality is indicative of adequate mixing time, consistency and relevant time limits.
d. Acceptable general condition of concrete base prior to placement.
e. Concrete conveyance and depositing avoids segregation and contamination.
f. Concrete is properly consolidated.
g. Reinforcement remains in proper location during concrete placement.
h. For all embedments installed in concrete, verify specified size, type, spacing, configuration, embedment, quantity, concrete placement and consolidation.
i. Post-installed anchors including conformance with manufacturer’s installation procedures and the requirements of the ICC ESR report(s).
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures. Verify hot and/or cold weather procedures are followed.

I. Strength Test Samples:
1. Sampling Procedures: ASTM C172.

2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
3. Sample concrete and make one set of five 4x8 or four 6x12 cylinders for each day's pour between one and 25 cubic yards. If a day's pour exceeds 25 cubic yards, make five 4x8 or four 6x12 cylinders for each additional 50 cubic yards.
4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
5. Make one additional cylinder during cold weather concreting, and field cure.

J. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C173/C173M or ASTM C231.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

K. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39/C39M.
2. Test Acceptance: In accordance with ACI 318.
3. Test one cylinder at 7 days.
4. Test three 4x8 or two 6x12 cylinders at 28 days.
5. Retain one cylinder for 56 days for testing when earlier tests show low strength.
6. Dispose remaining cylinders when testing is not required.

L. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: ASTM C42/C42M.
2. Test Acceptance: In accordance with ACI 318.
3. Drill three cores for each failed strength test from concrete represented by failed strength test.

M. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

N. Reinforcement Inspection:
1. Placement Acceptance: Specified material requirements and specified placement tolerances.
2. Welding: Inspect welds in accordance with AWS D1.1 and D1.4.
3. Placement Inspection Prior to Each Pour:
   a. Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover splicing, lap lengths and coatings.
   b. Verify bars are free of dirt, oil, excessive rust and damage.
   c. Verify bars are adequately tied, chaired and supported to prevent displacement during concrete placement.
4. Weldability Inspection: If welding becomes necessary inspect for reinforcement weldability.
5. Continuous Weld Inspection: Inspect reinforcement welding as required by the 2020 Minnesota Building Code, Table 1705.3, Item 2c.
6. Periodic Weld Inspection: Welded connections. Coordinate with requirements in Section 051200.

O. Test Results:
1. Submit test reports with information requested in Submittals portion of this Section.
2. Report in writing on same day tests made.
3. Non-Compliant Test Reports: All test reports indicating non-compliance should be e-mailed or faxed immediately to all parties on the test report distribution list. Copies shall be on different colored paper.

P. Additional Tests:

1. Testing service shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Structural Engineer or Architect.
2. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.10 CONCRETE PROTECTING AND CURING

A. Protect finished work under provisions of Section 01 60 00.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305 for hot-weather protection during placement.

D. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

E. Cure concrete for a duration and with means and methods adequate to ensure that 100% of the specified value for concrete properties are developed at 28 days.

F. Changes in temperature of concrete shall not exceed 5 deg F in any one hour or 50 deg F in any 24 hour period.

G. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.1 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions one or more times after placing, screeding, and bull floating or darbying concrete, but before float finishing.

H. Formed Surfaces: Cure formed concrete surfaces utilizing final curing methods per ACI 308.1, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure, after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period, as follows.
   1. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
   2. Continuous Sprinkling: Maintain concrete surface continuously wet.
   3. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   4. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   5. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      a. Recoat areas subject to heavy rainfall within three hours after initial application.
      b. Maintain continuity of coating and repair damage during curing period.

I. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces utilizing final curing methods per ACI 308.1.
   1. Immediately after conclusion of concrete finishing operations, cure newly placed concrete slabs to receive exterior concrete penetrating sealer, interior concrete penetrating sealer/hardener, ceramic tile, or quarry tile or other subsequent flooring finishes or treatments in accordance with ACI 308.1 utilizing one or a combination of the following methods.
      a. Water Cure: Cure continuously for seven days utilizing sprinklers, soaker hoses, ponding, or fog spray. Take care to prevent erosion damage to the surface of the concrete.
      b. Absorbent Cover: water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers when placing. Provide continuous supply of moisture such as sprinklers or soaker hoses when high temperature, low humidity, or windy conditions prevail. Do not allow Absorbent Cover materials to dry out during specified curing period.

c. Moisture Retaining Cover with Fabric Curing: Cover concrete surfaces with moisture-retaining cover meeting ASTM C171 as soon as possible after final finishing without marring the surface. Place in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. On flat surfaces such as pavements, the cover shall extend beyond the edges of the slab at least twice the thickness of the slab. The cover shall be placed flat on the concrete surface, avoiding wrinkles, to minimize mottling immediately after wetting the slab to rejection. It shall be placed and weighted so that it remains in contact with the concrete during the specified duration of curing. Windrows of sand or earth, or pieces of lumber shall be placed along all edges and joints in the film to retain moisture and prevent wind from getting under the film and displacing it. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   1) Moisture Retaining Fabric shall be installed in accordance with manufacture's written recommendations, in largest practical widths. Wet the slab to rejection then thoroughly wet fabric side of cover and install with poly side up. Lap over adjacent covers a minimum 18". Weight all laps and outside edges to prevent displacement and to ensure intimate contact with concrete and adjacent covers. Rewet as necessary and protect covers from damage during curing process.

d. Floors to Receive Curing Compound:
   1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions. Ensure complete and even coverage on surface of concrete, which may require multiple coats at right angles to one another.
   2) Follow manufacturers recommendations on timing of application to the concrete surface in relation to presence of bleed water and water sheen on surface.
   3) Recoat areas subjected to heavy rainfall within three hours after initial application.
   4) Maintain continuity of coating, protect surfaces from other trades, and repair damage during curing period.
   5) 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.

3.11 FLOOR TREATMENT

A. Liquid Sealer Densifier Finish: Apply this compound on exposed interior floors as indicated on the drawings. Application shall be made in strict accordance with the directions of the manufacturer and just prior to completion of construction. Spray, squeegee or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.

B. Concrete must be a minimum 28 days old, dry, clean, and free of loose dust, dirt, oil, and traces of curing compounds or any other surface contaminations that could interfere with bond of coating.
   1. Close spaces in which sealer is being applied to traffic, and keep closed 48 hours minimum after last application is completed.
   2. Prepare substrate in accordance with manufacturer's instructions.
   3. Apply a final finish coat within the recommended recoat time. Apply at approximately 700 to 800 sq. ft. per gallon and buff into surface with a high-speed burnisher

3.12 EXISTING WORK

A. Where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.

3.13 PATCHING AND CLEANING FORMED SURFACES

A. Patch tie holes and defective areas immediately after form removal.

B. Clean exposed concrete to remove laitance, efflorescence and stains.

C. Rough Form Finish: Patch holes and defects; otherwise leave surfaces with texture imparted by forms.

D. Smooth Form Finish: Patch holes and defects; completely remove fins by rubbing with wood blocks.

3.14 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details, and elevations.

B. Repair or replace concrete not properly placed or of the specified type.

C. Patch imperfections to match in place concrete.

END OF SECTION

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete such as wall panels, sills, wall caps, column features, light sconce backing etc.

B. Supports, anchors, and attachments.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements.

E. Section 03 20 00 - Concrete Reinforcement.

F. Section 03 30 00 - Cast in Place Concrete.

G. Section 04 20 00 - Unit Masonry Assemblies.

H. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. ACI 301 American Concrete Institute; Specifications for Structural Concrete.

B. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products; 2021.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

I. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle; 2021.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

K. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.

L. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

M. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

N. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

O. ASTM C939/C939M - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method); 2016.

P. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

Q. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2024.

R. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

S. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

T. ASTM C1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction; 2018.

U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

V. COE CRD-C 621 - Specification for Non-Shrink Grout; 1988.

W. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.

X. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).

1.04 FIELD SAMPLES

A. Provide architectural precast concrete for field sample construction as designed by Architect. Field sample to indicate proposed range of color, texture and workmanship expected in completed work.

1.05 MOCK-UPS

A. Provide architectural precast concrete for mock-up construction as designed by Architect.
   1. Mock-up to indicate proposed range of color, texture and workmanship expected in completed work.

B. Coordinate mock-up with Section 04 20 00 - Unit Masonry.

C. Obtain acceptance of visual qualities of mock-up prior to proceeding with work.

1.06 SYSTEM DESCRIPTION

A. Members to withstand own weight, design loads due to pressure and suction of wind, erection forces, and live and dead loads.

B. Component connections to accommodate building movement. Provide adjustment to accommodate misalignment of structure without permanent distortion, damage to components, wracking of joint connection, breakage of seals, or moisture penetration.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Design members under direct supervision of Professional Engineer experienced in design of precast concrete units.

C. Conform to requirements of PCI MNL-120 Manual for Structural Design of Architectural Precast Concrete and to ACI 318.

D. Precast Manufacturer and Erectors: Qualified in accordance with PCI MNL-117.

E. Welding: AWS D1.1/D1.1M.

F. Manufacture, Transportation, and Installation: Company specializing in providing architectural precast products and services normally associated with precast concrete construction with high quality architectural finishes.

1.08 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00-Submittals:
   1. Shop Drawings: Including the following:
      a. Unit dimensions.
      b. Finishes.
      c. Reinforcement and connection details.
      d. Unit installation locations and identification marks.

e. Fabrication details.
f. Relationship to adjacent materials.
g. Erection drawings.

2. Manufacturer's Installation Instructions: Include surface cleaning instructions.
3. Samples: Submit two (2) 12" x 12" samples for approval of workmanship, finish and color. Each sample to show joint between pieces.
4. Mix Design: Indicate proposed mix design of each class of concrete to Architect/Engineer review 15 days prior to commencement of work. Do not begin concrete production until mixes have been reviewed and accepted by Architect/Engineer.
   a. Submit proposed mix design for each class of concrete specified, at least 14 days prior to placing the concrete. Include proportions of ingredients, aggregate analysis, cement brand and type, slump, water/cement ratio, and strength test reports for 7 and 28 day strengths.

B. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

C. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

1.09 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference under provisions of Section 01 31 00 Project Management and Coordination one week prior to commencing work of this Section.
1. Require attendance of Contractor, precast installer, and parties' directly affecting work of this Section.
2. Review conditions of installation, installation procedures and coordination required with Related Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect under provisions of Section 01 60 00 - Materials and Equipment.

B. Handle precast members to position, consistent with their shape and design. Lift and support only from support points.

C. Lifting or Handling Equipment: Capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

D. Blocking and Lateral Support during Transport and Storage: Clean, non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

E. Protect edges of members to prevent staining, chipping, or spalling of concrete.

F. Mark units with date of production and final position in structure, in location not visible to exterior view.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Prior Approved Manufacturer, Certified by the Cast Stone Institute.

2.02 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Portland Type I or Type III - normal white. All cement shall be from the same source throughout out project.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C150.
2. Fly Ash: ASTM C618, Class C or F.
3. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.

C. Fine and Coarse Aggregate: ASTM C33/C33M and ASTM C330/C330M.

D. Water: Drinkable.

E. Reinforcing Steel: ASTM A615/A615M deformed steel bars, galvanized finish; strength and size commensurate with precast unit design.

2.03 ADMIXTURES

A. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

B. Air Entraining Admixture:
   1. Air entraining admixture shall comply with ASTM C260/C260M, and be certified by the manufacturer to be compatible with other admixtures to be used. Acceptable manufacturers and products:
      a. Euclid Chemical Company - Air Mix or AEA-92 Series.
      b. Grace Construction Products - Darex or Daravair series.
      c. BASF - MB-VR or MB-AE.

C. Water-Reducing Admixture:
   1. Manufacturers:
      a. Euclid Chemical Company, Eucon Series.
      b. BASF, Pozzolith Series.
      c. WR Grace, WRDA Hycol.
   2. Conform to ASTM C494/C494M, Type A.
   3. Compatible with other admixtures in the same mix design.

D. Water-Reducing, Retarding Admixture:
   1. Manufacturers:
      a. Euclid Chemical Company, Eucon Retarder - 75 or Eucon DS.
      b. BASF, Pozzolith 100XR.
      c. WR Grace, Daratard Series.
   2. Conform to ASTM C494/C494M, Type D and not more than 0.05 percent chloride ions.
   3. Compatible with other admixtures in the same mix design.

E. High-Range Water-Reducing Admixture:
   1. Manufacturers:
      a. Euclid Chemical Company, Eucon 37, 537 or Plastol Series.
      b. BASF, Rheobuild 1000 or Glenium Series.
      c. WR Grace, Daracem or Adva series.
   2. Conform to ASTM C494/C494M, Type F or Type G and containing not more than 0.05 percent chloride ions.
   3. Compatible with other admixtures in the same mix design.

F. Viscosity Modifying Admixture (VMA): Liquid admixture used to optimize viscosity of Self-Consolidating Concrete (SCC). Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer's recommendation:
   1. "Visctrol", The Euclid Chemical Company.
   2. "Boral SL", Boral Material Technologies.
   3. "Rheomac VMA Series", Master Builders.

G. Non-corrosive, Non-chloride Accelerator: The admixture shall conform to ASTM C494/C494M, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.
   1. Manufacturers:
      a. Euclid Chemical Company, Accelguard 80/90 or NCA.
      b. Conform to ASTM C494/C494M, Type C or E.
      c. Compatible with other admixtures in the same mix design.

H. Alkali-Silica Reactivity Inhibitor: A specially formulated lithium nitrate admixture for the prevention of alkali-silica reactivity (ASR) in concrete. The admixture must have test data indicating conformance to ASTM C1293, “Standard Test Method for Concrete Aggregates by Determination of Length Change of Concrete Due to Alkali-Silica Reaction”.
   1. Manufacturers:
      a. “Eucon Integral ARC” by Euclid Chemical Co.

I. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, non-fading, and resistant to lime and other alkalis.
   1. Manufacturers:
      a. Davis Colors.
      b. Solomon Colors.
      c. Increte/Euclid Chemical.
   2. Color: As selected by Architect from manufacturer's full range.

J. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.04 GROUT MATERIALS

A. Non-shrink Grout: Conforming to ASTM C1107/C1107M "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink). Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7000 psi in 28 days;
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "Masterflow 713", BASF
      b. "Euco-NS', Euclid Chemical Co;
      c. "Five Star Grout," U.S. Grout Co;

B. Non-Shrink Grout for Pre-Cast: Non-shrink, non-staining, high strength grout, conforming to ASTM C1107/C1107M “Standard Specification for Packaged Dry Hydraulic-Cement Grout, and providing extended working time for setting pre-cast concrete members; providing an initial setting time of 50 minutes per ASTM C191, providing positive expansion of .06% at 28 days, and capable of developing minimum compressive strengths of 5000 psi at 1 day and 12,000 psi at 28 days.
   1. Products: Subject to compliance with requirements, provide the following or approved equal:
      a. Euco Pre-cast Grout.

C. Cable Grout: Extremely flowable, pumpable, non-shrink, high-strength grout providing corrosion protection for steel cables, anchorages, and rods; providing a minimum flow rate of 15 to 25 seconds per ASTM C939/C939M and COE CRD-C 621; capable of developing minimum compressive strengths of 3000 psi at 1 day and 10000 psi at 28 days.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Euco Cable Grout.

2.05 REPAIR MATERIALS

A. Epoxy Adhesive: ASTM C881/C881M, 2-component, 100% solids, epoxy resin, of type, grade and class to suit requirements.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dural Series by The Euclid Chemical Co
      b. Sikadur Series by Sika Corp.

B. Bonding Agent: ASTM C1059/C1059M, Type II, non-re-dispersible, acrylic emulsion or styrene butadiene.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. “Flexcon” or “Akkro 7T”; Euclid Chemical Company.
      b. “Daraweld”; WR Grace.
      c. “Sika Latex”; Sika Corp.

C. Pre-Packaged Repair Mortar: Fast-setting, Portland cement based, repair mortar, capable of achieving a minimum 6,100 psi compressive strength in 28 days.
   1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
      a. Speedcrete Redline by The Euclid Chemical Co.

2.06 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A36/A36M weldable steel.

B. Bolts, Nuts, and Washers: ASTM A370; high strength steel.

C. Anchors and Dowels:
   1. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, epoxy or stainless steel Type 302 or 304.

2.07 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. Prepare design mixes for each type of concrete required. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-05. Submit mix designs on each class of concrete for. If field experience based mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1,200 psi higher than the specified strength. This over-design shall be increased to 1,400 psi when concrete strengths of 5,000 or more are used. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data. The testing facility shall not be the same as used for field quality control testing.
   1. Limit use of fly ash to not exceed 25 percent of cementitious content by weight.
   2. Limit use of slag to not exceed 40 percent of cementitious content by weight.
   3. The exact percentages used shall be based on a successful test placement on-site.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to .05%

D. Normal-Weight Concrete: materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength: 5000 psi at 28 days.

E. Self-consolidating concrete may be used for all architectural concrete and heavily reinforced members where noted on the plans, when approved by the architect/engineer. The concrete shall contain the specified high range water reducing admixture and viscosity modifying admixture as required. Slump flow shall be 20” to 30”. A successful placement onsite is required to verify proper workability, pumpability, setting time, and finish.

F. Admixtures:
   1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
   2. Accelerating: Use the specified non-corrosive accelerator in all concrete, less than 8 inches in thickness, placed at air temperature below 50 degrees Fahrenheit.
   3. Use high-range water-reducing admixture in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, self-consolidating concrete, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
   4. All concrete exposed to freezing and thawing and/or required to be watertight shall have an air content of 4.5% to 7.5%. All interior, slabs subject to vehicular abrasion, shall have a maximum air content of 3%.

G. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.08 JOINT SEALING

A. Provide non-sag, urethane joint sealant (SLNT-1) at perimeter and intermediate joints in accordance with Section 07 92 00 - Joint Sealants.

2.09 FABRICATION

A. Maintain plant records and quality control program during production of precast units. Make records and access to plant available to Architect upon request.

B. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

C. Maintain consistent quality during manufacture.

D. Embed reinforcing steel, anchors, inserts, plates, angles, and other cast-in items as indicated on shop drawings.

E. Fabricate connecting devices, plates, angles, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

F. Locate hoisting devices to permit removal after erection.

G. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

H. Minor patching in plant acceptable, providing structural performance and appearance of units is not impaired.

I. Identify each precast unit with corresponding code on erection drawings, in location not visible in finish work.

2.10 FINISH - PRECAST UNITS

A. Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

B. Architectural Concrete Finish: Provide smooth, uniform finish upon form removal with no patching, stoning, or other form of repair, except washing, permitted unless otherwise noted, for walls, columns, and other surfaces visible to view when the work is complete. Use Self Consolidating Concrete. The surface shall match the approved jobsite mockup panel.

C. Color: Submit samples from manufacturer’s full range of colors for architect’s approval.

D. Texture: Light acid etch.

2.11 FINISH - SUPPORT DEVICES

A. Clean surfaces of rust, scale, grease and foreign matter.

B. Prime paint non-exposed connectors in two coats, except surfaces in direct contact with concrete or requiring field welding.

C. Galvanize exposed connectors after fabrication to 2.0 oz/sq ft in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify building structure, anchors, devices, and openings are ready to receive work of this Section.

B. Beginning of installation means acceptance of existing condition.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

B. Provide necessary hoisting equipment.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect members level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When members require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.

E. Fasten units in place. Perform welding, including tack welds, in accordance with AWS D1.1/D1.1M.

F. Touch-up field welds and scratched or damaged galvanized surfaces with cold process galvanizing coating in accordance with manufacturer's instructions.

G. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Grout pack base of unit.

H. Seal perimeter and intermediate joints in accordance with Section 07 92 00 - Joint Sealants with SLNT-1.

I. Provide cotton rope weeps at each panel joint 6" above grade.

3.04 TOLERANCES

A. Offset from True Alignment Between Two Connecting Members: 1/8" maximum.

B. Out of Square: 1/8" in 10 feet maximum, non-cumulative.

C. Variation in Dimensions Indicated on Shop Drawings: Plus or minus 1/8".

D. Misalignment of Anchors, Inserts, Openings: 1/8" maximum.

E. Exposed Joint Dimension: 3/8" plus or minus 1/8".

3.05 PROTECTION

A. Protect members from damage.

B. Provide non-combustible shields during welding operations.

3.06 CLEANING

A. Clean all exposed surfaces after installation, in accordance with manufacturer's instructions. Use non-harmful, non-discoloring, and non-staining agents and devices. Protect adjacent areas from rundown.

B. Do not use metal cleaning tools and brushes or abrasive powders.

END OF SECTION

SECTION 04 00 10
DIVISION 4 TABLE OF CONTENTS

1.01 DIVISION 04 – MASONRY

04 20 00 - Unit Masonry

END OF SECTION

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SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete masonry units (CMU's).
   2. Face brick.
   3. Joint reinforcement, anchorage and accessories.
   4. Installation of reinforcing bars in unit masonry.
   5. Installation of anchor bolts and other embedments in unit masonry.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 33 - Code-Required Special Inspections and Procedures.

E. Section 01 60 00 - Product Requirements.

F. Section 03 20 00 - Concrete Reinforcement.

G. Section 03 30 00 - Cast in Place Concrete.

H. Section 07 27 26 - Fluid Applied Membrane Air Barriers.

I. Section 07 21 00 - Thermal Insulation.

J. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

F. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2016.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

H. ASTM C55 - Standard Specification for Concrete Building Brick; 2023.

I. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.

J. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.

K. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.

L. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.

M. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.

N. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

P. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

Q. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.

R. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

S. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

T. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

U. ASTM C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste; 2020.

V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

W. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

X. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale); 2022.

Y. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2023.

Z. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2025.

AA. ASTM C1506 - Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters; Current Edition.

BB. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

CC. ASTM D2287 - Standard Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds; 2019.

DD. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

EE. NCMA TEK 8-2A - REMOVAL OF STAINS FROM CONCRETE MASONRY; Current Edition.

FF. NCMA TEK 10-2D - CONTROL JOINTS FOR CONCRETE MASONRY WALLS—EMPIRICAL METHOD; Current Edition.

GG. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

HH. Brick Industry Association (BIA) Technical Notes on Brick Construction 2006.

1.04 SUBMITTALS

A. Coursing shop drawings (stone walls):
   1. Submit proposed coursing pattern for approval by Architect.

B. Concrete Masonry Units:
   1. Submit certification of type, density, shrinkage and shape of concrete masonry units for each size/shape used.
   2. Submit material certificates for each size and type of product, including ASTM C90 certification and ASTM C140/C140M test data. Testing shall be within the 12-months prior to the start of construction.
   3. Show conformance to shape requirements.

C. Grout:
   1. Mix Design for each type of grout used (proportions of ingredients).
   2. Material certificates: Portland Cement (ASTM C150/C150M), Fly Ash (ASTM C618), Hydrated Lime (ASTM C207).
   3. Gradation of aggregates (ASTM C404).
   4. Test breaks or historical data.

D. Mortar:
   1. Mix Designs for each type of Mortar used.
   2. Material certificates: Portland Cement (ASTM C150/C150M), Hydrated Lime (ASTM C207).
   3. Gradation of sand (ASTM C144).
   4. Range of colors for Architect's selection.

E. Submit product data and certification of masonry products to include:
   1. Rebar positioners.
   2. Horizontal joint reinforcement.
   3. Veneer anchors.
   4. Adjustable wall ties.
   5. Rigid anchors.
   6. Dovetail ties.

F. Samples for Verification: For each type and color of exposed masonry unit and mortar.

G. 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.

H. Mock-up:
   1. See requirements for Mock-up panel in drawings and in Quality Assurance below.

I. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

J. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Submit documentation indicating compliance with requirements for specified compressive strength of masonry f'm in accordance with the following. Testing to be arranged by Contractor and performed by testing agency contracted by Owner:
   1. Unit Strength Method:
      a. Determine compressive strength of masonry, based on strength of unit and type of mortar and masonry grout specified using TMS 402/602, Table 2. The following articles must be met:
         1) Units conform to ASTM C55 or ASTM C90 and are sampled and tested in accordance with ASTM C140/C140M.
         2) Masonry grout to meet specified requirements.
         3) Mortar strength test in accord with ASTM C270.

C. Masonry Standard: Comply with TMS 402/602 unless modified by requirements in the Contract Documents.

D. Masonry Installer shall be certified by the Mason Contractors Association of America (MCAA).

E. Mock-up Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 1 Section 01 40 00 "Quality Requirements" for mockups.
   1. Refer to drawings for more information on mock-up panel.

2. Build sample panels to include each type of exposed unit masonry construction: See drawings for panel size.
3. Construct sample panel such that all portions of the assembly are exposed. Include back up wall, vapor barrier, insulation, brick ties, mortar, drainage material, vents, weeps, and opening (if any).
4. Sample panel shall not be incorporated into completed work.

1.06 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not work in temperatures below 35 degrees F and between 35 degrees F and 45 degrees F only when proper provision are made to protect the work from freezing for at least 48 hours after laying. Use enclosures as required. Remove any work exposed to freezing. Remove any frost from masonry setting beds and dry surface before laying brick. Obtain Owner's approval for all heating ingredients. The contractor shall provide artificial heat to enclosures in work areas when temperatures fall below 45 degrees F approved by Owner in advance.

B. Hot-Weather Requirements (above 80 degrees F): Protect the masonry and mortar from direct sunlight and exposure to wind to avoid rapid evaporation of water in the mortar before during and after masonry construction.

C. Mix mortar using sufficient quantities of water to ensure good workability in accordance with BIA recommendations. Control batching procedures to ensure proper and consistent proportions by measuring materials by volume. Use calibrating containers for each of the constituents for all batches throughout the project. Do not use shovel measurements of sand. Use volumetric dispenser for color admixtures where used. Mix with mechanical mortar mixer only for at least 3 minutes, but not more than 15 minutes. Use only workable mortar. Limit retempering to the extent practical and only retemper mortar on the board or in the tub one time. Completely clean remaining mortar off boards or tubs before adding fresh mortar. Use mortar within 2 hours of initial mixing at temperatures over 80 degrees F and 2 ½ hours at temperatures between 50 degrees F and 74 degrees F.

PART 2 PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   1. Structural walls shall be comprised of double corner units, open end (‘A’ Shaped) units, or double open end (‘H’ shaped) units. Use of stretcher block in structural walls may be subject to rejection.
      a. Stretcher units shall not be used in structural walls.

B. Finish:
   1. Typical: Standard.

C. CMUs: ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
   2. Density Classification: Normal weight.

2.03 BRICK

A. General: Provide shapes indicated and as follows:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C652.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Approved Manufactures and product:
         1) Metro Brick Company:
            (a) FBR-1: Fast Ship Blend #4
            (b) FBR-2: Fast Ship Blend #5
      b. Face Brick: ASTM C216:
         1) Size: Utility, 3-5/8” by 3-5/8” x 11-5/8”.
         2) Brick Pattern:3/4 Bond typ; Window Header Soldier course only. See elevations.
         3) Concave joints.
      c. Grade: SW.
      d. Type: FBX.
      e. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
      f. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C67/C67M.
      g. Efflorescence: Provide brick that has been tested according to ASTM C67/C67M and is rated "not effloresced."
      h. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 feet (3 m).
      i. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 3-5/8 inches (92 mm) high by 11-5/8 inches (295 mm) long.

2.04 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cements are NOT acceptable.

D. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Colored Portland Cement-Lime Mix:
         1) Holcim; Rainbow Mortamix.
         2) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
         3) Or approved equal.
      b. Color: Submit full range of colors for Architect's Selection.

E. Aggregate for Mortar: ASTM C144.
   1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
   2. White-Mortar Aggregates: Natural white sand or crushed white stone.
   3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Euclid Chemical Company (The); Accelguard 80.

b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF; MasterSet FP 20.

G. Water: Potable.

2.05 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 9 gage.
4. Wire Size for Cross Rods: 9 gage.
5. Wire Size for Veneer Ties: 9 gage.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
8. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: truss type with single pair of side rods.
1. Products: Subject to compliance with requirements. Provide one of the following: Single Wythe Joint Reinforcement: Truss type; hot dipped galvanized to comply with ASTM A153/A153M, Class B2 coating; 9 gage side rods and cross ties. Provide preformed corners and tees.
a. Hohman and Barnard, Inc., Lox-All No. 125 Truss-Mesh.
b. Dur O Wal, Inc., Dur O Wal Truss.
c. Wire Products, Blok Trus AA600.
d. Masonry Reinforcing Corporation of America, Series 300, Single Wythe Truss Type.
e. Or approved equal.

D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 9 gage, hot-dip galvanized, carbon-steel continuous wire.

2.06 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
2. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Adjustable “Mechanical” Anchors for Connecting to Cold-Formed Steel Framing: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Backplate fastened through sheathing to cold-formed steel framing and extending through rigid insulation with hole for pintle attachment; formed from 12-gauge thick, galvanized after fabrication.
a. Fastener: No. 10 self-drilling screw.
2. Pintles: 1/4" diameter 2 wire brite galvanized steel anchors hot dipped galvanized to comply with ASTM A153/A153M, Class B2 coating; size for 4” quarried stone and variable air space up to 6”.
a. Hohman and Barnard, Inc.
b. Wire Products.
c. Dur O Wall, Inc.
d. Masonry Reinforcing Corporation of America.
e. Or approved equal.

2.07 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Rubberized-Asphalt 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing; CCW-705-TWF XLT Thru-Wall Flashing.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
   c. Hohmann & Barnard, Inc.; Textroflash.
   d. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
   e. Or approved equal.

B. Stainless Steel Base Flashings and Drip Edges: See section 07 62 00.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 - Sheet Metal Flashing and Trim. Solder all flashing joints / end dams water tight see sheet metal section 07 62 00 for additional information.

D. 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.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
   1. Control Joint Resilient Keys: Shall be a poly vinyl chloride section with a minimum Shore Durometer hardness of 80. Shear section is 5/8” thick with 5/16” thick flanges. Total width shall be not less than 2 3/8”.
      a. Hohmann & Barnard Inc.; VS series (PVC joint)
      b. Wire-Bond; PVC joint.
      c. Dur-O-Wal - Rapid Poly Joint (PVC) regular.
      d. AA Wire Products - Blok-tite.
      e. Or approved equal.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Cellular Plastic Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
   1. Vent Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Heckmann Building Products Inc.; No. 85 Cell Vent.
      b. Hohmann & Barnard, Inc.; Quadro-Vent.
      c. Or approved equal.

D. Rope Weeps: 3/8” diameter 100% cotton rope wicks, including core.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Mortar Net USA, Ltd.; Mortar Net.
      b. Advanced Building Products Inc. MortarBreak.
      c. Or approved equal.
   2. Installation: Install products according to the sizes, vertical spacing, and locations as recommended by manufacturer.
   3. Color to be selected by architect.

F. Reinforcing Bar Positioners: 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 0.148-inch (9 gage) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

2.09 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime mortar.
   4. For reinforced masonry, use portland cement-lime mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
   6. Water-reducing admixture is allowed only when approved by the Architect and Structural Engineer of Record, and only when the following conditions are continuously met when grouting cores:
      a. Fog or wet block cores to saturated surface dry (SSD) condition prior to and during grouting.
      b. Wet Faceshells of grouted block during grout cure.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Polymer-Modified Mortar:
   1. One-component, polymer fiber reinforced veneer mortar, to meet or exceed ASTM C270 compressive strength requirements and IBC ASTM C482 Shear bond strength requirements, and ANSI A118.4 for adhered stone and tile.
   2. For use to adhere exterior thin masonry units as shown on drawings.
      a. Exposed joints shall use Cementitious Mortar above.
   3. Manufacturers and Products:
      a. Basis of Design: Laticrete MVIS Veneer Mortar.
      b. Or approved equal.
   4. Water: Potable.

D. Mortar for Unit Masonry: Comply with ASTM C270, Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type M or S.
   3. For exterior, unreinforced, above-grade, use Type N.
   4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
   5. For applications where another type is not indicated, use Type N.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match adjacent masonry unit, provide color chart for architect approval. Match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
      a. Face Brick: Assume (2) different colors. Architect to select colors from manufacturer's full range.

F. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402/602 for dimensions of grout spaces and pour height.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. 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. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

B. Do not use over burned or oil or grease marked bricks. Do not use bricks with cracks or splits in any face or with chips extending more than 1/8” from edges or ¼” from corners. Do not lay bricks until they are at least 60 days old.

C. When installing masonry under hot or cold conditions, follow guidelines found in BIA technical notes #1.

3.02 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
   2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
   3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in 3/4 bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

F. Protect incomplete masonry wall whenever work is not being performed by installing well fastened water proof coverings. Protect flashing against penetration or damage.

3.04 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units 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.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

F. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

G. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
   1. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3.05 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.0 sq. ft. (0.19 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
   2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
      b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Apply air barrier to face of backup wythe to comply with Section 07 27 26.

D. Installing Cavity-Wall Insulation (where shown on drawings): Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.06 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.07 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches (406 mm) o.c. vertically and 16 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 2.0 sq. ft. (0.33 sq. m) of wall area. Install additional anchors within 8 inches (305 mm) of openings and at intervals, not exceeding 16 inches (914 mm), around perimeter.

3.08 MASONRY CONTROL AND EXPANSION JOINTS

A. Install control joints where indicated on drawings.
   1. Where no joints are indicated, place joints every 20' OC on exterior walls, and every 25' OC in interior walls. Place joints according to NCMA TEK 10-2D.
      a. In areas exposed to view, coordinate joint location with Architect.

B. Joints to be 3/4" wide, unless detailed otherwise.

C. Install expansion joint material as specified above and as detailed on drawings.

D. Reinforce joints as recommended by NCMA standards.

3.09 FLASHING, WEEP HOLES, AND CAVITY DRAINAGE

A. General: Install embedded flashing and weep holes/vents in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Slope flashing to exterior to promote prompt drainage. May slope 1/8” across brick width. Integrate flashing with backup wall waterproofing/ air barrier. Lap back up wall water proofing over unturned legs of through wall flashing 4”. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams. Solder all joints / end dams water tight.
   3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
   4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
   5. Install flashing or drip edge in bed of sealant. See detail.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and at last head joint at top of cavity as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Locate Cavity vents at top and bottom of masonry wall sections as shown on drawings.
   3. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Masonry Unit Test: Performed in accordance with TMS 602, as follows:
   1. Verify units conform to ASTM C 55 or ASTM C 90.
   2. Test units according to ASTM C 140 prior to the start of construction.
   3. During construction, provide one set of tests for each 5,000 SF of wall area, but not less than one set for the project.

C. Testing of Grout: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump at each grout pour.

D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780, 2500 psi.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019, 3,000 psi.

G. Masonry Preparation and Placement: Verify that masonry bearing surfaces are clean, that masonry units are clean, sound and dry. Inspect laying of masonry units for nominal unit widths, stack bond, size and location of structural elements, proper thickness and tooling of mortar joints and acceptable depth of furrowing of bed joints. Verify hot and cold weather procedures are followed.

H. Masonry Reinforcement: Inspect placement and alignment of vertical and horizontal reinforcement and dowels for size, grade and spacing. Inspect length of lap splices, clearances between bars, clearances to masonry units and outside face of walls, and positioning of steel. Inspect ties in masonry for type, straightness, embedment, spacing and size. Inspect the type, size location, and installation of masonry anchorage to structural members, frames, and other construction. Inspect welding of reinforcement in accordance with AWS D1.1.

I. Masonry Grouting: Verify that grout spaces are correctly sized and clean, cleanouts are closed after inspection and grout barriers are in place before grouting. Verify proper grouting technique including consolidation to approved height of grout space, reconsolidation and vibration.

3.11 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
   2. Protect surfaces from contact with cleaner.
   3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
   6. Clean from top to bottom in small sections.

3.12 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 00 10
DIVISION 5 TABLE OF CONTENTS

DIVISION 05 – METALS

05 12 00 - Structural Steel Framing
05 21 00 - Steel Joist Framing
05 31 00 - Steel Decking
05 40 00 - Cold-Formed Metal Framing
05 50 00 - Metal Fabrications
05 51 00 - Metal Stairs
05 70 00 - Decorative Metal
05 73 13 - Glazed Decorative Metal Railings

END OF SECTION

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Anchor bolts/anchor rods.
   3. Non-Shrink Grout.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 33 - Code-Required Special Inspections and Procedures.

E. Section 01 60 00 - Product Requirements.

F. Section 03 20 00 - Concrete Reinforcement.

G. Section 03 30 00 - Cast in Place Concrete.

H. Section 04 20 00 - Unit Masonry Assemblies.

I. Section 05 21 00 - Steel Joist Framing.

J. Section 05 31 00 - Steel Decking.

K. Section 05 40 00 - Cold Formed Metal Framing.

L. Section 06 20 00 - Rough Carpentry.

M. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2023).

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2024b.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

H. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

J. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

K. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.

L. ASTM A668/A668M - Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use; Current Edition.

M. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

N. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

O. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

P. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

Q. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

R. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

S. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

T. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; Current edition.

U. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

V. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

X. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

Y. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

Z. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

AA. SSPC-SP 2 - Hand Tool Cleaning; 2024.

BB. SSPC-SP 3 - Power Tool Cleaning; 2024.

CC. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

DD. SSPC-SP 10 - Near-White Metal Wet Abrasive Blast Cleaning; 2015.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawing submittals must conform with coordinated BIM models. See Section 01 31 00.05.

C. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, headed studs, counts, camber, holes, and other pertinent data.
   2. Indicate all materials, sizes, spacing, locations of structural members, openings, attachments, and fasteners. Show cambers.
   3. Include embedment drawings.
   4. 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.
   5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
   6. Shop drawings indicating number of studs and placement along beams. Actual stud layout to be provided in deck shop drawings.
   7. For structural steel connections that differ from those detailed in the Drawings, the fabricator shall design the connections in accordance with AISC 360 using LRFD methods.
      a. Include structural design data (calculations) signed and sealed by qualified professional engineer, registered in the state of the project, responsible for their preparation.

b. Calculation shall be organized, clear and concise and shall include table of contents and page numbers.
c. Calculations shall be submitted concurrently with shop/erection drawings and shall be signed and sealed at time of submission. Shop drawings submitted without corresponding calculations will not be reviewed by the engineer.
d. Shop Drawings received without corresponding calculations will not be reviewed by the Engineer.

8. Phasing diagram indicating scope of work for each phase of work.
9. Changes from Construction documents:
   a. Cloud and clearly identify all changes or deviations from the construction documents.

D. Qualification Data: For qualified installer, fabricator (including AISC Certification), professional engineer, testing agency.

E. Welding certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

G. Mill test reports for structural steel, including chemical and physical properties.

H. 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. Shop primers.
5. Non-shrink grout.

I. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

J. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.

C. Installer Qualifications: Qualified installer who participates in AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

D. Welding Qualifications: Qualify procedures and personnel per AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing Work on bottom-flange, demand-critical welds shall pass supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 360.
3. RCSC (HSBOLT) "Specification for Structural Joints Using High Strength Bolts."

1.06 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 fasteners and for retesting fasteners after lubrication.

1.07 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure 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 Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. W-Shapes: ASTM A992/A992M, Grade 50 (345).

B. Channels, Angles, S, M HP, C and, MS Shapes: ASTM A36/A36M or ASTM A572/A572M, Grade 50 (345).

C. Plate and Bar: ASTM A36/A36M or ASTM A572/A572M, Grade 50 (345).

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C, structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E, Grade B.

F. Steel Castings: ASTM A216/A216M, Grade WCB with supplementary requirement S11.

G. Steel Forgings: ASTM A668/A668M.

H. Welding Electrodes: Comply with AWS requirements. Provide E70 electrodes unless indicated otherwise.
   1. For Demand Critical Welds of members that are part of the Seismic Force Resisting System, weld filler metals shall meet the requirements of AWS D1.8/D1.8M clauses 6.1, 6.2 and 6.3.

I. Headed Anchors and Threaded Studs:
   1. As manufactured by Nelson Division of TRW, or equal conforming to ASTM A108 and AWS D1.1/D1.1M.
   2. Minimum Fu = 65 ksi.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563/A563M, Grade C, Class 8S heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Minimum Diameter: 3/4 inch (76 mm).

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563/A563M, Grade DH, Class 10S heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip zinc coating.

C. Headed or Threaded Anchor Rods: ASTM F1554, Grade 36, or Grade 105 (As indicated on the drawings) straight.
   1. Nuts: ASTM A563/A563M hex carbon steel.
   2. Plate Washers: ASTM A36/A36M carbon steel.
   3. Washers: ASTM F436/F436M, Type 1, hardened carbon steel.

4. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B, unfinished.

2.03 NON-SHRINK GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, non-corrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Acceptable Products:
      1) Masterflow 928 by BASF Building Systems.
      2) Hi-Flow Grout by Euclid.
      3) Substitutions: as approved ty the Engineer

2.04 WATER PROTECTIVE COATING

A. Basis of Design.
   1. Carboline - “Bitumastic No. 50” or "Bitumastic 300M"

B. Other acceptable products:
   1. Rustoleum - "Coal Tar Epoxy C9578"
   2. Carboline - "Carboguard 635"
   3. Carboline - "Carbomastic 615"
   4. Or approved equal.

2.05 PRIMER

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15, lead- and chromate-free, nonasphaltic, rust-inhibiting, complying with MPI (APSM) #79 and compatible with topcoat.

2.06 POST INSTALLED ANCHORS

A. Type, size and embedment indicated on Drawings:
   1. Provide product indicated on drawings. (No Substitutions)

2.07 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate per AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel per ASTM A6/A6M and maintain markings until structural steel 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. Holes: Provide holes required for securing other Work to structural steel and for other Work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other Work.

2.08 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts per RCSC (HSBOLT) "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding Work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
2. For Demand Critical Welds of members that are part of the Seismic Force Resisting System, comply with the requirements of AWS D1.8/D1.8M.

2.09 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 (50.8 mm).
   2. Surfaces to be field welded.
   3. Galvanized surfaces.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79, VOC requirements in 09 91 00 Painting and compatible with topcoat.

C. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces per the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."
   3. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."

D. Priming: Immediately after surface preparation, apply primer per 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 2 coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Painting: Prepare steel and apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.10 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to structural steel per ASTM A123/A123M.
   1. Fill vent and drain holes that will be exposed in finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

B. Galvanizing Repair Paint: ASTM A780/A780M.

PART 3 EXECUTION

3.01 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.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Do not remove temporary supports until structure is complete (structural steel, connections, and bracing are in place, concrete slabs have reached design strength and roof deck and deck connections are complete, etc.).

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and per AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete-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 when indicated on drawings.
   3. Snug-tighten 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 grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

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 will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   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 use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors per AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts per RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding Work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

C. For Demand Critical Welds of members that are part of the Seismic Force Resisting System, comply with the requirements of AWS D1.8/D1.8M.

D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect items listed in drawings and in section 01 45 33.

B. Refer to the Structural Drawings for the Schedule of Special Inspections along with the information outlined below.

C. Structural Configuration and Materials:
   1. On a periodic basis, verify mill test reports and other submitted documentation, for compliance with contract document. Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include structural steel, bolts, electrodes, steel deck gage.

2. Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings).
3. Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.
4. Inspect the following to verify member orientation, configuration, type, and size comply with details indicated on the contract documents an approved shop drawings:
   a. Bracing and stiffening members.
   b. Proper applications of joint details at connections for structural members.

D. Bolted Connections: Bolted connections will be tested and inspected per RCSC's "Specification for Structural Joints Using High Strength Bolts."
1. General:
   a. On a periodic basis, verify material conforms to specified ASTM standards. Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting. Verify that the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
   b. On a continuous basis, observe calibration procedures when such procedures are required by the installation method or in the contract documents.
   c. Comply with the additional requirements of AISC 341, “Seismic Provisions for Structural Steel Buildings”, Appendix Q “Quality Assurance Plan”.
2. Fully-Pretensioned, Slip Critical and Tension Bolts:
   a. On a continuous basis, verify that selected procedure is used to tighten bolts. Monitor bolt installation when the calibrated wrench method or turn of the nut method without match marking is used.
   b. On a periodic basis, monitor bolt installation if the turn-or-the-nut method with match marking, direct tension indicator, or "twist off bolt" methods are used. Visually verify tightening of all bolts.
   c. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2 of ASTM F 959.
3. Bearing Bolts:
   a. On a periodic basis, visually inspect to verify all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)

E. Welding/Welded Connections: Field welds will be visually inspected per AWS D1.1/D1.1M. 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. General:
   a. Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to the Owner, Authority Having Jurisdiction, Architect and SER. Verify qualifications of all welders as AWS certified. Verify manufacturer’s certificate of compliance for weld filler materials. Verify proposed welding procedures and materials meet AWS requirements.
   b. On a periodic basis, verify adequate preparation of faying surfaces. Verify preheat and interpass temperatures of steel, proper technique and sequence of welding, and cleaning and number of passes are provided as required.
   c. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   d. Testing/Inspection shall be as follows:
      1) Ultrasonic Inspection: ASTM E164
      2) Liquid Penetrant Inspection: ASTM E165
      3) Magnetic Particle Inspection: ASTM E709
      4) Radiographic Inspection: ASTM E94
   e. Comply with the additional requirements of AISC 341, “Seismic Provisions for Structural Steel Buildings”, Appendix Q “Quality Assurance Plan”.
2. Fillet Welds:

a. On a periodic basis, visually inspect 100% of all fillet welds 5/16" or less, for size, length, and quality, per AWS D1.1.
b. On a continuous basis, inspect welding process for all multi-pass fillet welds and single pass fillet welds greater than 5/16".

3. Partial Penetration and Full Penetration Welds:
   a. On a continuous basis, inspect welding process for all groove welds per AWS D1.1.
   b. Test 100% of all welds exceeding 5/16 inch, using Ultrasonic Testing per AWS D1.1. Test 25% of all welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E-109, performed on root pass and on finished weld.
4. Stud Shear Connector Welds:
   a. Visually inspect 100% of installed studs for full 360° flash. Test all questionable studs, not showing full 360° flash by bending studs to 15° from vertical, away from weld discontinuity, per AWS D1.1.
   b. Randomly test all other studs by bending to 15° from vertical as noted:
      1) Studs welded thru deck 15%
      2) Studs welded to bare steel 5%
      3) Alternatively, sound 100% of installed studs, for full penetration weld, using an 8 lb. maul. Test questionable studs as noted above.
   c. Verify all welding ferrules have been removed.
5. Steel Joist/Joist Girder Welds:
   a. Provide testing and inspection for field welds previously described.
6. Metal Deck Welds:
   a. On a periodic basis, visually inspect size, location, length and burn thru for 100% of puddle welds and top seam welds on metal deck designed as a structural element, per AWS D1.3.
7. Welding of Reinforcing Bars:
   a. Prior to welding, verify weldability of reinforcing steel other than ASTM A706. Verify proper joint preparation is provided and proper electrodes are used and properly stored and dried.
   b. On a continuous basis, visually inspect 100% of all reinforcing bar welds as the welding is performed, per AWS D1.4.
8. Miscellaneous Metals, Inserts and Prefabricated Components:
   a. Where integrity of the connections impact life safety or performance of the building structure, provide testing and inspection as for typical welds previously specified.

F. Correct deficiencies in Work that test reports and inspections indicate does not comply with Contract Documents.

G. Perform additional testing to determine compliance of corrected work with specified requirements.

END OF SECTION

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. K-series steel joists.
   2. KCS-type K-series steel joists.
   3. K-series steel joist substitutes.
   4. Long-span steel joists.
   5. Joist girders.
   6. Joist accessories.

1.02 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.03 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 33 - Code-Required Special Inspections and Procedures.

E. Section 01 60 00 - Product Requirements.

F. Section 03 20 00 - Concrete Reinforcement.

G. Section 04 20 00 - Unit Masonry Assemblies.

H. Section 05 12 00 - Structural Steel Framing.

I. Section 05 31 00 - Steel Decking.

J. Section 05 40 00 - Cold Formed Metal Framing.

K. Section 06 10 00 - Rough Carpentry.

L. Section 07 81 00 - Applied Fireproofing.

M. Section 09 91 00 - Painting.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2023).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service; 2021.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

I. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

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K. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

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N. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

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P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

S. SJI Standard Specification - STANDARD SPECIFICATION FOR K-SERIES, LH-SERIES, AND DLH-SERIES OPEN WEB STEEL JOISTS AND FOR JOIST GIRDERS.; Current Edition.

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

U. SSPC-SP 2 - Hand Tool Cleaning; 2024.

V. SSPC-SP 3 - Power Tool Cleaning; 2024.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

B. Design joists to withstand design loads as follows:
   1. Design loading per ASCE 7, the Structural Notes and Structural Drawings
   2. Design framing systems to withstand design loads without deflections greater than L/360 under live or snow loading and L/240 under combined dead and live or snow loading.

1.06 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings:
   1. Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
   2. Indicate locations and details of bearing plates to be embedded in other construction.
   3. Submit a layout plan indicating all loads and locations of loads in which the joists have been designed for and all connection details.
   4. After picking up the reviewer’s remarks submit for record, final shop drawings along with comprehensive engineering analysis of joists. Shop drawings and calculations shall be signed and sealed by a qualified professional engineer, registered in the state of the project, responsible for their preparation.
   5. Final signed and sealed shop drawings and calculations are submitted for engineer’s record only, and will not be reviewed.

C. Welding certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

F. Qualification Data: For manufacturer and professional engineer.

G. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

H. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

I. Research/Evaluation Reports: For joists.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
   1. Manufacturer's responsibilities include providing professional engineering services for designing joists to comply with performance requirements.

C. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
   1. Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Bearing Plates: ASTM A36/A36M.

C. Steel Castings: ASTM A216/A216M.

D. Steel Pipe: ASTM A53/A53M.

E. Steel Structural Tubing: ASTM A500/A500M.

F. Structural Steel Shapes: ASTM A992/A992M.

G. Carbon-Steel Bolts and Threaded Fasteners: ASTM A307, Grade A carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Plain

H. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M 325 Type 1, heavy hex steel structural bolts; ASTM A563/A563M heavy hex carbon-steel nuts; and ASTM F436/F436M hardened carbon-steel washers.
   1. Finish: Plain

I. Welding Electrodes: Comply with AWS standards.

2.02 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

B. Primer: Provide shop primer that complies with Section 09 91 00.

2.03 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI Standard Specification, with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI Standard Specification, with steel-angle or channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications," or as indicated on plan.

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.04 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joist girders.

D. Camber joist girders according to SJI's "Specifications," or as indicated on plans.

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.05 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability. Bridging shall terminate in the final joist space and shall not extend or connect to adjacent walls or beams.

B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.06 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

D. Shop priming of joists and joist accessories is specified in Division 9.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High Strength Bolts" RCSC (HSBOLT) for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords at terminations.

G. Do not permit erection of roof decking until joists are braced, secured and ready for decking install.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:
   1. Radiographic Testing: ASTM E94/E94M.
   2. Magnetic Particle Inspection: ASTM E709.
   3. Ultrasonic Testing: ASTM E164.
   4. Liquid Penetrant Inspection: ASTM E165/E165M.

D. Bolted connections will be visually inspected.

E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using High Strength Bolts." RCSC (HSBOLT)

F. Refer to section 051200 “Structural Steel Framing” and the Schedule of Special Inspections on the Structural Drawings for additional information.

G. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

H. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.04 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 section 09 91 00 Paints and Coatings.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Roof deck.
   2. Composite Deck.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.
B. Section 01 31 00.05 - Project BIM Coordination.
C. Section 01 33 00 - Submittal Procedures.
D. Section 01 40 00 - Quality Requirements.
E. Section 01 45 33 - Code-Required Special Inspections and Procedures.
F. Section 01 60 00 - Product Requirements.
G. Section 03 20 00 - Concrete Reinforcement.
H. Section 03 30 00 - Cast in Place Concrete.
I. Section 05 12 00 - Structural Steel Framing.
J. Section 05 21 00 - Steel Joist Framing.
K. Section 05 40 00 - Cold Formed Metal Framing.
L. Section 05 50 00 - Metal Fabrications.
M. Section 05 51 00 - Metal Stairs.
N. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.
O. Section 07 81 00 - Applied Fireproofing.
P. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. AISC 303 Code of Standard Practice for Steel Buildings and Bridges.
B. AISC 360 Specification for Structural Steel Buildings.
C. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
D. ASTM A216/A216M Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
E. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
F. ASTM A572/A572M Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
H. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

K. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

M. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

N. SDI (DM) Steel Decking Institute; Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Work Completed under this section must be coordinated with other work using BIM modelling. See Section 01 31 00.05 for requirements.

1.05 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Submit BIM models as required by Section 01 31 00.05.

C. Shop Drawings:
   1. Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction, including field fastening pattern and sidelap fastener type and pattern.
   2. Shop Drawing submittals must conform with coordinated BIM models. See Section 01 31 00.05.
   3. Show compliance with specified deck section and material properties as indicated on construction documents. Decking shall meet or exceed all specified properties.
   4. Shear stud layouts showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.
   5. At composite deck, provide max unshored clear span tables for each deck gauge and concrete thickness shown.
      a. Deck to be designed per ANSI/SDI-C-1.0.
   6. Phasing diagram, if applicable, indicating scope of work for each phase of work.
   7. Changes from construction documents:
      a. Cloud and clearly identify all changes or deviations from the construction documents.

D. Product Certificates: For each type of steel deck, signed by product manufacturer.

E. Welding certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.
   2. Acoustical roof deck.

H. Research/Evaluation Reports: For steel deck.

I. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.
   1. Manufacturer shall be a member of the Steel Deck Institute

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 for testing indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Mechanical Fasteners: Qualify mechanical fastening systems, procedures, and personnel in accordance with the "Standard for Quality Control and Quality Assurance for Installation of Steel Deck" from ANSI / SDI and with Manufacturer's qualification standards.

E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
   2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

F. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

G. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

H. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.08 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Deck:
      a. ASC Profiles, LLC.
      b. Nucor Corp.; Vulcraft Division.
      c. Verco Decking, Inc. a NUCOR company.

2.02 NON-COMPOSITE ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), yield strength of 50ksi or higher, G60 Galvanized, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Deck Profile: As indicated on drawings.
   3. Profile Depth: As indicated on drawings.
   4. Design Uncoated-Steel Thickness: As indicated on drawings.
   5. Span Condition: 3-span minimum.

6. Side Laps: Manufacturer’s proprietary interlocking sidelap for use with Manufacturer’s sidelap connector (Vulcraft PLB/Punchlock, ASC DGB/Deltagrip).

2.03 COMPOSITE METAL DECK

A. Composite Metal Decking: ASTM A653/A653M SS Grade 50 or higher, Galvanized G90, cold rolled steel sheet, 24” or 36" wide sheets.
   1. Deck profile: As indicated on drawings.
   2. Profile depth: As indicated on drawings.
   3. Design thickness: As indicated on drawings.
   4. Span condition: 3-span minimum.
      a. Where 3-span conditions cannot be met, or framing configuration does not permit for 3-span condition, increase deck gauge as necessary to enable unshored construction.
   5. Finish: Galvanized G60 or phosphatized and painted, or as indicated in architectural drawings.

2.04 DECK FASTENING AT SUPPORTS

A. Provide fastening as shown in the Structural Drawings.

2.05 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

C. 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.

D. 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 recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

E. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

F. Galvanizing Repair Paint: ASTM A780/A780M, SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

G. See Specification Section 05 12 00 for steel headed studs.

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

I. Flute Closures: Closed cell foam rubber 1 inch minimum thick; profiled to fit tight to deck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29 & 30, manufacturer's written instructions, and requirements in this Section.

B. Install decking and accessories as noted in deck shop drawings, including shortened deck widths arranged to minimize cutting deck and using fillers at structural steel girders.

C. Install temporary shoring before placing deck panels, if required to meet deflection or strength limitations.

D. Locate deck bundles to prevent overloading of supporting members.

E. 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.

F. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

G. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

I. Comply with AWS D1.1/D1.1M requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

J. Install sidelap fasteners/attachments as indicated on the Drawings.

K. Immediately after welding deck in place, touch-up welds, burned areas, and surface coating damage with prime paint.

L. Additional Composite deck requirements:
   1. Install side lap fasteners 12”oc maximum, or as indicated in Drawings, whichever is more stringent.
   2. Confirm that all plies are in contact upon fastening.
   3. Openings in bare deck shall be reinforced.
   4. Coring of deck to occur only after concrete is placed and has reached 75% of design strength.
   5. Deck installer to follow reviewed shop drawings with respect to layout, fillers, and fastening, including the strategy of starting bays with special sized deck width so low flute lands on an interior girder.
   6. Ensure sufficient deck end bearing length (SDI minimum or greater) and side bearing width (for fasteners).
   7. Do not scorch top flute of deck when installing headed studs. Damaged deck shall be replaced.
   8. Do not use a hammer to stretch side margins of deck to reach supports. Where deck does not reach supports, the contractor shall submit proposed solution for review to the Engineer for approval.
   9. Provide 3-span, minimum. Where 3-span conditions cannot be met, or framing configuration does not permit 3-span condition, increase deck gauge as necessary to enable unshored construction.
   10. Contractor may shore deck at their discretion. Shoring shall be beam-to-beam and may not be supported from floor(s) below.

3.03 DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated as follows:
   1. Weld Diameter: 5/8 inch (16 mm)
   2. Weld Spacing: as indicated on the Structural Drawings.

B. Shear Studs:
   1. A welded headed stud may take the place of a puddle weld at composite deck.
   2. Weld studs through a singly ply of deck, placing studs directly over beam web.
   3. Use ferrules developed for weld-through technique. Remove after welding.

C. Side-Lap Fastening: Fasten side laps as follows:
   1. Roof Deck – fasten as indicated on the Structural Drawings
   2. Composite Deck - Mechanically fasten with self-drilling No. 12 diameter or larger, carbon-steel TEK screws at 12” oc, unless noted otherwise on structural drawings.

D. Install deck ends over supports with bearing lengths as follows:
   1. Roof Deck:
      a. End bearing: 2" minimum
      b. Interior bearing: lap ends 4” minimum centered over supports
   2. Floor Deck (Composite):
      a. End bearing on steel: 2" minimum; extend 1” minimum past support centerline.
      b. Interior bearing on steel: 4" minimum
         1) Butt ends together at joints in deck; bear 2” minimum

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
   1. Fasten metal roof deck at 6” oc at deck opening framing.
   2. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Fasten cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

H. Sound-Absorbing Insulation: Installation into topside ribs of deck per manufacturer’s recommendations.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Refer to section 051200 “Structural Steel Framing” and the Schedule of Special Inspections on the Structural Drawings for additional information.

D. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

E. Remove and replace work that does not comply with specified requirements.

F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9 Section 09 91 00 - Painting.

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9 Section 09 91 00 - Painting.

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Exterior Cold-Formed Metal framing.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 33 - Code-Required Special Inspections and Procedures.

E. Section 01 60 00 - Product Requirements.

F. Section 05 12 00 - Structural Steel Framing.

G. Section 05 21 00 - Steel Joist Framing.

H. Section 05 50 00 - Metal Fabrications.

I. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. AISI S100 “North American Specification for the Design of Cold-Formed Steel Structural Members”.

B. AISI S200 “North American Standard for Cold-Formed Steel Framing - General Provisions”.

C. AISI S201 “North American Standard for Cold-Formed Steel Framing - Product Standard”.

D. AISI S211 “North American Standard for Cold-Formed Steel Framing - Wall Stud Design”.

E. AISI S212 “North American Standard for Cold-Formed Steel Framing - Header Design”.

F. AISI S213 “North American Standard for Cold-Formed Steel Framing - Lateral Design”.

G. AISI “Code of Standard Practice for Cold-Formed Steel Structural Framing”.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

K. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

L. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

M. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; Current Edition.

N. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

O. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

P. ASTM E1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; Current edition.

Q. Other ASTM standards as specified below.

R. AWS D1.1/D1.1M Structural Welding Code - Steel

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in 01 40 00 “Quality Requirements“ to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: as indicated on Structural Drawings.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Wall Framing: Design wall framing to meet the following horizontal deflection conditions:
         1) EIFS Finishes: 1/360 of wall height under service level loading.
         2) Brick Veneer: 1/360 of wall height under service level loading.
      b. Interior Wall Framing: Horizontal deflection of 1/240 of wall height under a horizontal load of 5 pound-force per square foot.
   3. Design framing systems to provide for movement of framing members 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.
   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 as indicated on drawings.
      b. Design exterior non-load bearing framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Floor and Roof systems: AISI S210.
   2. Headers: AISI S212.
   3. Wall Studs: AISI S211.
   4. Lateral Design: AISI S213.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.05 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Provide shop drawings prepared by cold-formed metal framing designer.
   1. Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   3. For cold-formed metal framing indicated to comply with design loads, include comprehensive structural analysis and detailed shop drawings, signed and sealed by the qualified professional engineer, registered in the state of the project, responsible for their preparation.
      a. Comprehensive structural analysis shall be submitted concurrently with related shop drawings.
      b. Calculation shall be organized, clear and concise and shall include table of contents and page numbers.
      c. Shop Drawings received without corresponding calculations will not be reviewed by the Engineer.
      d. Include design/analysis of the substructure system and connections used to connect the architectural finishes to the underlying wall or substrate. Refer to the architectural finish manufacturer’s ICC reports for additional requirements for support and fastening.
   4. Resubmittals, if necessary, shall Cloud and clearly identify revisions from previous submittals.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

F. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

G. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

H. Research/Evaluation Reports: For cold-formed metal framing.

I. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention, and any other information specified by manufacturer not covered in structural drawings. For all non-standard cold-formed steel shapes and framing, submit research reports from ICC-ES.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer, registered in the state of the project, responsible for their preparation.

C. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated.

E. 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, ductility, and metallic-coating thickness.

F. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," and AWS D1.3, "Structural Welding Code - Sheet Steel."

G. Comply with AISI Specifications and Standards.
   1. AISI S100 “North American Specification for the Design of Cold-Formed Steel Structural Members”.
   2. AISI S200 “North American Standard for Cold-Formed Steel Framing - General Provisions”.
   3. AISI S201 “North American Standard for Cold-Formed Steel Framing - Product Standard”.
   4. AISI S211 “North American Standard for Cold-Formed Steel Framing - Wall Stud Design”.
   5. AISI S212 “North American Standard for Cold-Formed Steel Framing - Header Design”.
   6. AISI S213 “North American Standard for Cold-Formed Steel Framing - Lateral Design”.
   7. AISI “Code of Standard Practice for Cold-Formed Steel Structural Framing”.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
   1. ClarkDietrich Building Systems.
   2. The Steel Network.
   3. Approved company specializing in manufacturing products specified in this section with minimum three years documented experience; current member of Steel Stud Manufacturers Association.

2.02 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance with minimums as follows:
      a. 18 gauge and lighter: 33ksi minimum
      b. 16 gauge and heavier: 50ksi minimum
   2. Coating: G60 (Z180).

C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

2.03 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.

C. Headers and Jambs - Heavy-Duty Stud: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges.

D. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths and flange widths indicated, punched, with stiffened flanges.

E. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths and flange widths indicated.

2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths and flange widths indicated, punched, with stiffened flanges.

B. Minimum gauge: 18 ga.

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.

D. Headers and Jambs - Heavy-Duty Stud: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths and flange widths indicated, unpunched, with stiffened flanges.

E. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths and flange widths indicated, punched, with stiffened flanges.

F. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths and flange widths indicated.

2.05 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight 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. Anchor clips.
   4. Stud kickers, knee braces, and girts.

C. Deflection Track and Firestop Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thicknesses not less than indicated for studs and in width to accommodate depth of studs.

D. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure. Accommodate vertical movements as indicated in drawings.

E. 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 and lateral loads and transfer them to the primary structure. Install a continuous row of bridging, composed of 1-1/2 inch (38 mm) cold-formed channel secured to each stud with clip angle or Spazzer 5400, at upper-most knockout, not more than 12 inches (305 mm) from top of wall.

2.06 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Torsion anchor clips: Provide where indicated on drawings:
   1. ASTM A1003/A1003M Structural Grade 50 (340) Type H, ST50H (ST340H): 50ksi (340MPa) minimum yield strength, 65ksi (450MPa) minimum tensile strength. Size as indicated on drawings.
   2. Manufacturer/Product:
      a. The Steel Network/Stiffclip.
      b. ClarkDietrich/Easyclip.
      c. As required by the design

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web and capable of resisting forces imposed by the wall system.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E488/E488M conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

G. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS

A. Shims: Load bearing, high-density multi-monomer plastic, non-leaching.

B. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 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, and complying with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in one-piece lengths unless splice connections are indicated.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of (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 shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacing to match stud spacing.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs at 24 inches (610 mm).

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.

J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Spacing of studs not to exceed that indicated in drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb 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 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.

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. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 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.
   2. Bridging: Steel channel, welded or mechanically fastened to webs of punched studs.
   3. 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.
   4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. 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.

3.06 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. Refer to section 051200 “Structural Steel Framing” and the Schedule of Special Inspections on the Structural Drawings for additional information.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Ferrous Metals.
   2. Non-Ferrous Metals.
   3. Fasteners.
   4. Miscellaneous Materials.
   5. Miscellaneous Framing and supports:
      a. Steel framing and supports for overhead divider nets.
      b. Steel framing and supports for countertops.
      c. Steel framing and supports for mechanical and electrical equipment.
      d. Steel framing for equipment platforms.
      e. Steel framing and supports for Bistro.
      f. Elevator machine beams and hoist beams.
      g. Steel shapes for supporting elevator door sills.
   6. Metal ladders.
   7. Metal guardrail.
   8. Fixed and loose steel lintels.

B. Products furnished, but not installed, under this Section:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.03 RELATED SECTIONS:

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 31 00.05 - Project BIM Coordination.

C. Section 01 33 00 - Submittal Procedures.

D. Section 01 40 00 - Quality Requirements.

E. Section 01 60 00 - Product Requirements.

F. Section 03 30 00 - Cast-in-Place Concrete.

G. Section 04 20 00 - Unit Masonry Assemblies.

H. Section 05 51 00 - Metal Stairs.

I. Section 05 73 13 - Glazed Decorative Railings.

1.04 REFERENCE STANDARDS

A. AISC 360 Specification for Structural Steel Buildings.

B. ASCE/SEI 7 Minimum Design Loads For Buildings and Other Structures.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

J. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

L. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

P. ASTM B632/B632M - Standard Specification for Aluminum-Alloy Rolled Tread Plate; 2018.

Q. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

R. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

S. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

T. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

U. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric; 2016.

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

W. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

X. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

Y. MFMA-4 - Metal Framing Standards Publication; 2004.

Z. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

AA. NACE No. 3 - Joint Surface Preparation Standard Commercial Blast Cleaning; 1994 (Reaffirmed 2006).

BB. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.

CC. SSPC-SP 3 - Power Tool Cleaning; 2024.

DD. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Work Completed under this section must be coordinated with other work using BIM modelling. See Section 01 31 00.05 for requirements.

1.06 SUBMITTALS

A. Submit BIM models as required by Section 01 31 00.05.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Shop Drawing submittals must conform with coordinated BIM models. See Section 01 31 00.05.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Delegated-Design Submittal: For installed products 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. Calculation shall be organized, clear and concise and shall include table of contents and page numbers.
   2. Calculations shall be submitted concurrently with shop/erection drawings and shall be signed and sealed at time of submission.
   3. Changes from Construction documents:
      a. Cloud and clearly identify all changes or deviations from the construction documents.

E. Qualification Data: For qualified professional engineer.

F. Welding certificates.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

H. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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."
   3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.09 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 anchorages and steel weld plates and angles for casting into concrete. 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

2.01 METALS, GENERAL

A. Metal Surfaces, 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.

2.02 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
   2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
   3. Material: Cold-rolled steel, ASTM A1008/A1008M, commercial steel, Type B; 0.0966-inch (2.5-mm) minimum thickness; unfinished.

2.03 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior. Select fasteners for type, grade, and class required.

B. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M; and, where indicated, flat washers.

C. 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 E488/E488M, conducted by a qualified independent testing agency.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107/C1107M, specifically recommended by manufacturer for heavy-duty loading applications.

E. 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).

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. 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. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Prime miscellaneous framing and supports with universal shop primer unless noted otherwise.

D. Galvanize and prime miscellaneous framing and supports with universal shop primer where indicated on drawings.

E. Counter/Bench Mounting brackets: See drawings for locations.
   1. Custom Steel tube or angle brackets:
      a. See drawings for size and location.
   2. Prefabricated Steel Brackets: Low profile, concealed counter brackets
      a. Manufacturer and Product:
         1) FastCap; Stealth SpeedBrace.
         2) Or approved equal.
      b. Pair of brackets must support min 300 lbs.
      c. Size as indicated on drawings and as recommended by Manufacturer for the application.
   3. Sauna Bench hardware: See detail.
      a. 6x6 12 ga galv bracket.
         1) Simpson A66
         2) or Equal.
      b. 2 1/2 x 1 1/2" 18 ga clip
         1) Simpson A23
         2) or Equal.

2.07 FIXED AND LOOSE STEEL LINTELS

A. Fabricate fixed and 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. Loose lintels shall be sized to provide sufficient bearing length as noted in Drawings

C. Galvanize (G90) and prime with universal shop primer loose steel lintels located in exterior walls..

2.08 FABRICATION, GENERAL

A. 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.

B. 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.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. 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.

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 will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.09 FINISHES, GENERAL

A. Comply with NAAMM AMP 500-06 "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 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.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.11 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

3.01 INSTALLATION, 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 will 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.

3.02 INSTALLING 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.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or non-metallic, in concealed locations where not exposed to moisture; use non-shrink, non-metallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Industrial-type stairs with steel floor plate treads.
   2. Ornamental steel-framed metal pan stairs.
   3. Steel tube railings attached to stairs or ramps.
   4. Steel tube handrails attached to walls adjacent to stairs or ramps.

B. See 05 73 13 for Stainless Steel Glazed Decorative railings.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 31 00.05 - Project BIM Coordination.

C. Section 01 33 00 - Submittal Procedures.

D. Section 01 40 00 - Quality Requirements.

E. Section 01 60 00 - Product Requirements.

F. Section 03 20 00 - Concrete Reinforcement.

G. Section 03 30 00 - Cast-in-Place Concrete.

H. Section 04 20 00 - Unit Masonry Assemblies.

I. Section 05 21 00 - Steel Joist Framing.

J. Section 05 50 00 - Metal Fabrications.

K. Section 05 73 13 - Glazed Decorative Metal Railings.

L. Section 06 10 00 - Rough Carpentry.

M. Section 09 30 00 - Tile.

N. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. AISC 303 Code of Standard Practice for Steel Buildings and Bridges.

B. AISC 360 Specification for Structural Steel Buildings.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

G. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

H. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2020a.

I. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.

J. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

M. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

N. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018 (Reapproved 2023).

O. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric; 2016.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

Q. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

R. NAAMM AMP 510 - Metal Stairs Manual; 1992.

S. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

T. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.

U. SSPC-SP 3 - Power Tool Cleaning; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Work Completed under this section must be coordinated with other work using BIM modelling. See Section 01 31 00.05 for requirements.

1.05 PERFORMANCE REQUIREMENTS

A. Design stairs and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity and lateral loads including finishes and the following loads and stresses within limits and under conditions indicated.
   1. Uniform Live Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
   2. Concentrated Live 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. Wind Loads: As required by ASCE 7 for the wind speed and exposure shown in the structural drawings.
   5. Seismic Loads: As required by ASCE 7 for the seismic parameters shown in the structural drawings.
   6. Importance factor shall be 1.5.
      a. Stairs and isolation joints shall accommodate a lateral seismic story drift of 1” (ground floor to 2nd floor).
   7. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   8. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

C. Structural Performance of Railings: 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.

1.06 SUBMITTALS

A. Product Data: For metal stairs.

B. Submit BIM models as required by Section 01 31 00.05.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Shop Drawing submittals must conform with coordinated BIM models. See Section 01 31 00.05.
   3. Fabricator is responsible for designing and detailing all connections to supporting structures, including embedded items. All applied loads from the stairs to the support structure shall be clearly defined within the shop drawings.
   4. Include embedment drawings.
   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.
   6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   7. For stairs and components indicated to comply with design loads, include comprehensive structural analysis design data signed and sealed by qualified professional engineer, registered in the state of the project, responsible for their preparation.
      a. Calculation shall be organized, clear and concise and shall include table of contents and page numbers.
      b. Calculations shall be submitted concurrently with shop/erection drawings and shall be signed and sealed at time of submission.
      c. Shop Drawings received without corresponding calculations will not be reviewed by the Engineer.
   8. Resubmittals, if necessary, shall cloud and clearly identify revisions from previous submittals.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: Fabricator of products.

C. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
   1. Industrial-Type Stairs: Industrial class.
   2. Ornamental Stairs: Architectural class.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.08 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 anchorages for metal stairs. 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.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: 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.

2.02 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. General: Comply with the following: ASTM A572/A572M, ASTM A992/A992M.

C. Steel Plates, Shapes, and Bars: ASTM A36/A36M, ASTM A53/A53M.

D. Steel Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

E. Rolled-Steel Floor Plate: SDI (DM), ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. 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.

G. Expanded-Metal, Carbon Steel: ASTM F1267, Type I (expanded), Class 1 (uncoated).

H. Woven-Wire Mesh: Intermediate-crimp, diamond pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A510/A510M.

2.03 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3,000 psi (20 MPa) unless otherwise indicated.

2.05 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure. All components to comply with NAAMM AMP 510.
   1. Join components by welding unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.
   3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

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. 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.
   5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.06 STEEL-FRAMED STAIRS

A. Stair Framing:
   1. Fabricate stringers of steel channels or tubes as indicated in Drawings.
      a. Provide closures for exposed ends of tube stringers.
   2. Construct platforms of steel channel or tube headers and miscellaneous framing members as indicated.
   3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
   4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
      a. Hangers from construction above permitted only as indicated in Drawings. Coordinate all support conditions with Architect and Engineer.
   5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness indicated.
   1. Steel Sheet: Uncoated hot-rolled steel sheet.
   2. Steel Sheet: Galvanized-steel sheet, where indicated.
   3. 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.
   4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.

C. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from checkered rolled-steel floor plate of thickness needed to comply with performance requirements, but not less than 1/8 inch (3.2 mm).
   1. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
   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.

2.07 RAILINGS

A. Comply with applicable requirements in Section 05 73 13 - Glazed Decorative Metal Railings.
   1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
   2. Connect posts to stair framing by direct welding unless otherwise indicated.

B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
   1. Rails and Posts: 1-5/8-inch- (41-mm-) diameter top and bottom rails.

2. Picket Infill: Minimum of 1/2-inch- (13-mm-) pickets spaced less than 4 inches (100 mm) clear.
3. Mesh Infill: Woven wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) steel channel frames. Orient wire mesh with diamonds vertical.
4. 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.

C. Welded Connections: Fabricate railings with 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. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

D. Form changes in direction of railings as follows:
1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.

E. Close exposed ends of railing members with prefabricated end fittings.

F. 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.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. Connect posts to stair framing by direct welding unless otherwise indicated.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.08 FINISHES

A. Comply with NAAMM AMP 500-06 "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
1. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. See Spec Section 09 91 00 for final paint finish.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
1. Coordinate all required anchorage / fastening conditions with General Contractor prior to construction.

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. 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.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 - Cast-in-Place Concrete.

3.02 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonmetallic, nonshrink grout unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
   1. Anchor posts to steel by welding directly to steel supporting members.
   2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Use type of bracket with predrilled hole for exposed bolt anchorage. Provide bracket with 1-1/2-inch (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. Secure wall brackets 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, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

END OF SECTION

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SECTION 05 70 00
DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior metal trim and reveals at tile and wood.

B. Interior metal wall guards.

C. Wire Mesh Partitions.

D. Decorative metal shelving.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 05 50 00 - Metal Fabrications.

F. Section 08 81 00 - Glazing.

G. Section 09 21 16 - Gypsum Board Assemblies.

H. Section 09 75 00 - Interior Stone.

1.03 REFERENCE STANDARDS

A. ASTM B36/B36M - Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar; 2023.

B. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2020.

C. ASTM B135/B135M - Standard Specification for Seamless Brass Tube; 2017.

D. ASTM B455/B455M - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2020.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

F. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric; 2016.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

H. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

I. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

J. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

K. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

L. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit the following:
   1. Full size templates for products requiring templates for fabrication.
   2. Drawings indicating locations of products of this section in project.

3. Drawings and details indicating sizes, materials and thicknesses, fabrication and installation techniques, provisions for reinforcement and anchoring, joinery, finishes, fasteners and accessory items.

D. Samples for Initial Selection: For products involving selection of color, texture, or design.

E. Samples for Verification: For each type of exposed finish.
1. Sections of linear shapes.
2. Full-size Samples of castings and forgings.
3. Samples of welded and brazed joints showing quality of workmanship and color matching of materials.

F. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Installer Qualifications: A firm approved by Fabricator of products to perform installation, with at least (5) years demonstrated experience in installing products of this type.

D. Finisher Qualifications: A firm experienced in successfully applying the specified finishes or coating indicated and employing competent control personnel to conduct continuing, effective quality-control to ensure compliance with requirements.

E. 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 D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

F. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockups for the following types of decorative metal:
   a. To be determined by owner.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling and Unloading: Pack products of this section to prevent damage to products and finishes.

B. Storage and Protection:
1. Store products in manufacturer's unopened packaging until installation.
2. Maintain dry, heated storage area for products until installation.

1.07 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 SCHEDULING

A. Supply full size templates for products requiring templates for fabrication to manufacturer of products of this section in time for scheduled fabrication.

PART 2 PRODUCTS

2.01 DECORATIVE METAL FABRICATORS

A. Metal fabricator by Contractor, Fabricators: Subject to compliance with requirements.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
   1. Extruded Shapes: ASTM B455/B455M, Alloy UNS C38500 (architectural bronze).
   2. Pipe: ASTM B43, Alloy UNS C23000 (red brass, 85 percent copper).
   3. Tube: ASTM B135/B135M, Alloy UNS C23000 (red brass, 85 percent copper).
   4. Retain one or all three options in "Castings" Paragraph below.
   5. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper).

2.03 PRODUCTS

A. Interior metal trim and reveals:
   1. MTL-7
      a. Manufacturer: Stylmark.
      b. Product Number: 110080
      c. Size: ¾” x 1” x 1/16” U Channel.
      d. Color: Brushed Brite Aged Brass 21BRS80003.
      e. Location: Coffee Bar Service Line.
   2. MTL-14
      a. Manufacturer: Stylmark.
      b. Product Number: 150014
      c. Size: 1 1/2" x 3/4" x 3/32"
      d. Color:
         1) Brushed Brite Brown 216
      e. Location: Cafe Entry, Indoor Liquor Bar base trim.
   3. MTL-15
      a. Manufacturer: Stylmark.
      b. Product Number: Stylmark Angle 110180
      c. Color:
         1) 22BRN80049
      d. Location: Furred out LED walls at Group Fitness, Barre and Cycle.

B. Interior metal wall guards.
   1. Stainless steel tread plate pattern sheet, Type 304, 16 ga (.063") with #4 satin finish.
      a. Pre-drilled for mechanical fasteners.
      b. Panel sizes: As shown on drawings.
      c. Panel trim:
         1) Trim to be provided by Millwork provider. See Section 06 40 00.
      d. Manufacturers and products:
         1) Wallguard, Protector Series 2449.
         2) Or Approved equal.

C. Wire Mesh Partitions:
   1. WMP-1
      a. Manufacturer: Banker Wire.
      b. Product: M31Z-6 Crimp Style
      c. Finish: Powder Coated - PCC-14 - See Section 09 91 00

d. Size: 240" H x 96" W
e. Location: Cafe
f. URL: https://www.bankerwire.com/products/m31z-6-architectural-woven-wire-mesh/
g. See 05 50 00 for framing.

D. Decorative Metal Shelves:
1. Prefabricated steel shelves with artificial patina:
a. Manufacturer: Delform Metal Fabrication.
b. Product: Custom shelving
c. Material: Cold rolled steel
d. Finish: Midnight
e. Laquer: Satin/Matte.
f. Location: Locker room vanities as indicated on drawings.

2.04 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
1. Aluminum Items: Type 304 stainless-steel fasteners.
2. Stainless-Steel Items: Type 304 stainless-steel fasteners.
3. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless-steel fasteners where exposed.
4. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
5. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.
1. Provide square or hex socket machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems 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 B633 or ASTM F1941/F1941M, Class Fe/Zn 5 unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify openings and substrates are prepared to receive products of this section.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with the manufacturers recommendations and the approved shop drawings.

B. Install plumb, level, square, and securely and in accordance with manufacturer’s instructions.

C. Factory-Painted Surfaces: Do not cut, drill, or weld unless required by approved shop drawings.

D. Protect against contact between dissimilar metals.

E. Where appropriate, supply products of this section for installation by installers of products of other sections.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 05 73 13
GLAZED DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Decorative railings with glass guard infill.
   2. Stainless steel guardrail cap.
   3. Stainless steel handrails.
   4. Aluminum base shoe.
   5. Stainless steel cladding over guardrail base shoe.
   6. Stainless steel wall mounted tubular handrails at pool circulation areas.

1.02 RELATED REQUIREMENTS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 05 50 00 - Metal Fabrications.

F. Section 05 51 00 - Metal Stairs.

G. Section 08 81 00 - Glazing.

1.03 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.

1.04 REFERENCE STANDARDS

A. AAMA CW 12 - Structural Properties of Glass; 1984.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.

C. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2022a.

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

E. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2021.

F. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

I. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings; 2025.

J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

K. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

L. ASTM E894 - Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings; 2018.

M. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

N. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.05 PERFORMANCE REQUIREMENTS

A. 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. Stainless Steel: 60 percent of minimum yield strength.
   3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA CW 12, "Structural Properties of Glass."

B. Design railing system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 pounds per linear foot. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbs 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. 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.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.06 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of railings assembled from standard components.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For railing system indicated to comply with performance requirements and design criteria, including calculations signed and sealed by the qualified professional engineer responsible for their preparation.

D. 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.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

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.

D. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.09 COORDINATION AND SCHEDULING

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 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.

C. 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

2.01 MANUFACTURERS

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. Decorative Railings:
      a. Global Glass Railings.
      b. Julius Blum & Co., Inc.
      c. Blumcraft, a division of C.R. Laurence Co., Inc.
      d. Hollaender Manufacturing Co.
      e. Or approved equal.

2.02 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 extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.03 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: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.

C. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.

D. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.

E. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.04 STAINLESS STEEL

A. Pipe: ASTM A312/A312M, Grade TP 304.

B. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

C. Sheet, Strip, Plate, and Flat Bar: ASTM A666/A666M, Type 304.

D. Bars and Shapes: ASTM A276/A276M, Type 304.

2.05 GLASS AND GLAZING MATERIALS

A. See Section 08 81 00.

B. Glazing Gaskets for Glass Infill Panels: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

2.06 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Aluminum Components: Type 304 stainless-steel fasteners.
   2. Stainless-Steel Components: Type 304 stainless-steel fasteners.
   3. Dissimilar Metals: Type 304 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 otherwise indicated.
   1. Provide tamper-resistant 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 E488/E488M, conducted by a qualified independent testing agency.

2.07 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.08 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. 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 work true to line and level with accurate angles and surfaces.

E. 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.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections at curved stairs and nonwelded connections at straight stairs unless otherwise indicated.

H. 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.

I. Form changes in direction as follows:
   1. Miter corners, welded and finished to # 4 satin.
   2. By bending or by inserting prefabricated elbow fittings.
   3. By radius bends of radius indicated.

J. 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.

K. Close exposed ends of hollow railing members with prefabricated end fittings. End caps provided shall have smooth edges and fit the exact profile of the handrail pipe.

L. 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.

M. 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.

N. 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.

O. 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.

2.09 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
   1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
   2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.

B. Structural Balusters: Provide tempered glass panels.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM AMP 500-06 "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 shipment.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.11 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.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.12 METAL CLADDING

A. Material: Stainless Steel.

B. Finish: Powder Coated to match handrail.

C. Attachment: Construction adhesive and VHB tape.

D. Location: Grand Stair, see drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. 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. 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. Provide field finishing for railing components that are required to be welded or cut in the field.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
   3. 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 (5 mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded 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 stainless steel 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.

3.04 ANCHORING POSTS

A. 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.

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 nonshrink, nonmetallic grout, 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. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

E. 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. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.05 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with sleeves concealed within 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 connected to railing ends using nonwelded connections.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch (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 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, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
   4. 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.
   5. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.06 INSTALLING GLASS PANELS

A. Glass-Supported Railings: 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.
   2. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement.
      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. 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.

3.07 INSTALLING GUARDRAIL CAPS

A. Apply stainless steel guardrail caps, where indicated, complying with manufacturer's written instructions for cutting, mounting, forming, welding, cleaning, applying end caps, and finishing.

B. Minimize number of joints in stainless steel caps by installing in lengths as long as possible. Allow for shortening of stainless steel cap caused by welding and splicing process; butt ends together to produce hairline joint.

3.08 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. 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.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.09 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

SECTION 06 00 10
DIVISION 6 TABLE OF CONTENTS

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

06 10 00 - Rough Carpentry
06 20 00 - Finish Carpentry
06 20 01 - Finish Carpentry Schedule
06 40 00 - Architectural Woodwork
06 40 01 - Architectural Woodwork Schedule
06 64 00 - Plastic Paneling
06 64 01 - Plastic Paneling Schedule

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Framing with dimension lumber.
   2. Treated Lumber:
      a. Wood preservative treated lumber.
      b. Fire retardant treated lumber.
   3. Rooftop equipment bases and support curbs.
   4. Miscellaneous Lumber:
      a. Wood blocking, and nailers.
      b. Wood furring.
      c. Wood sleepers.
   5. Plywood backing panels.
   6. Fasteners.
   7. Framing Anchors.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 01 45 33 - Code-Required Special Inspections and Procedures.
D. Section 01 60 00 - Product Requirements.
E. Section 03 30 00 - Cast-in-Place Concrete.
F. Section 05 12 00 - Structural Steel Framing.
G. Section 05 21 00 - Steel Joist Framing.
H. Section 05 31 00 - Steel Decking.
I. Section 05 40 00 - Cold-Formed Metal Framing.
J. Section 05 50 00 - Metal Fabrications.
K. Section 05 51 00 - Metal Stairs.
L. Section 06 20 00 - Finish Carpentry.
M. Section 06 40 00 - Architectural Woodwork.
N. Section 07 21 00 - Thermal Insulation.
O. Section 07 27 26 - Fluid-Applied Membrane Air Barrier.
P. Section 07 42 00 - Metal Wall Panels.
Q. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.
R. Section 07 62 00 - Sheet Metal Flashing and Trim.
S. Section 07 72 33 - Roof Hatches.
T. Section 08 11 13 - Hollow Metal Doors and Frames.
U. Section 08 14 16 - Flush Wood Doors.
V. Section 08 31 13 - Access Doors and Frames.
W. Section 08 33 23 - Overhead Coiling Doors.
X. Section 08 38 00 - Traffic Doors.
Y. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

Z. Section 08 44 13 - Glazed Aluminum Curtainwalls.

AA. Section 09 21 16 - Gypsum Board Assemblies.

BB. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

CC. Section 10 14 00 - Signage.

DD. Section 10 21 13.16 - Plastic Laminate Clad Toilet Compartments.

EE. Section 10 28 13 - Toilet and Bath Accessories.

FF. Section 11 66 00 - Athletic Equipment.

GG. Section 13 24 16 - Saunas.

1.03 REFERENCE STANDARDS

A. AHA A135.4 American Hardboard Association; Basic Hardboard.

B. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

C. AFPA (NDS) - National Design Specification for Wood Construction; 2018.

D. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2012 (Reaffirmed 2021).

E. ASME B18.6.1 - Wood Screws; 2016.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

L. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

M. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

N. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

O. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.

P. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

Q. ESR 1539 - Power Driven Staples and Nails; 2019.

R. PS 1 - Structural Plywood; 2023.

S. PS 20 - American Softwood Lumber Standard; 2025.

T. AWI/AWMAC/WI (AWS) American Woodworking Institute; Woodworking Standards.

U. ICC ES NES NER-272

V. BHMA Builder's Hardware Manufacturer's Association, Various standards as specified below.

W. NEMA LD 3 ANSI/NEMA Standard for High Pressure Laminates.

1.04 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.06 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. 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. 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.
   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.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 PRODUCTS

2.01 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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: Treat all miscellaneous carpentry, unless otherwise indicated.
1. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
2. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
3. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS (FRT)

A. General: Comply with performance requirements in AWPA U1.
1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Interior Type A for interior locations, unless otherwise indicated.
3. Use Exterior Grade Fire X for exterior conditions, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat all miscellaneous carpentry, unless otherwise indicated.

2.04 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking and Nailers.
2. Rooftop equipment bases and support curbs.
3. Furring.
4. Sleepers.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.

C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

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.

2.05 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

B. Other Applications:
1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667/F1667M.

C. Powder-Driven Fasteners: ESR 1539 or NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563/A563M hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488/E488M conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2.07 METAL FRAMING ANCHORS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Simpson Strong-Tie Co., Inc.
   2. USP Structural Connectors.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

2.08 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
   1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AFPA (NDS) "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
   3. 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.

H. Sort and select lumber so that natural characteristics will 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.

I. 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.

J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.02 WOOD SLEEPER, INSTALLATION

A. Install where indicated and where required for screeding or 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.

3.03 WOOD BLOCKING AND NAILER INSTALLATION

A. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.04 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Interior standing and running trim.
   2. Hardwood Veneer Plywood paneling.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 06 10 00 - Rough Carpentry.

E. Section 06 20 01 - Finish Carpentry Schedule.

F. Section 06 40 00 - Architectural Woodwork.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

C. ANSI A208.1 - American National Standard for Particleboard; 2022.

D. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

E. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

G. PS 1 - Structural Plywood; 2023.

H. PS 20 - American Softwood Lumber Standard; 2025.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NHLA: National Hardwood Lumber Association.
   2. NLGA: National Lumber Grades Authority.

B. MDF: Medium-density fiberboard.

C. MDO Plywood: Plywood with a medium-density overlay on the face.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.06 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

C. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

D. Warranty: Special warranty specified in this Section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: AHA/ANSI A135.4.

D. MDF: ANSI A208.2, Grade 130.

E. Particleboard: ANSI A208.1, Grade M-2.

F. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.F.

G. Low-Emitting Materials:
   1. Provide composite wood products containing no added urea formaldehyde.
   2. Adhesives applied on site shall comply with South Coast Air Quality Management District SCAQMD 1168.

2.02 STANDING AND RUNNING TRIM

A. Hardwood Lumber Moldings and Trim for Transparent Finish (Stain or Clear Finish):
   1. Species and Grade: White maple; Clear; NHLA.
   2. Maximum Moisture Content: 6 percent.
   3. Finger Jointing: Not allowed.
   4. Gluing for Width: Use for lumber trim wider than 6 inches (150 mm).
   5. Veneered Material: Allowed.
   6. Face Surface: Surfaced (smooth).
   7. Matching: Selected for compatible grain and color.

2.03 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dooge Veneers Inc.
   b. Georgia-Pacific Corp.
   c. RS Bacon Veneer Company.
2. Face Veneer Species and Cut: White Maple plain cut.
3. Veneer Matching: Selected for similar color and grain.
4. Backing Veneer Species: Any hardwood compatible with face species.
5. Construction: Veneer core.
6. Thickness: 1/16 inch (1.6 mm).
7. Panel Size: 48 by 96 inches (1219 by 2438 mm).
8. Glue Bond: Type II (interior).
9. Face Pattern: Manufacturer's standard-grooved pattern, with grooves at edges, center, and third points of panels, and at other locations to provide pattern resembling random width boards.
10. Finish: Manufacturer's standard, transparent, UV-resistant, protective finish.

B. See attached Finish Carpentry Schedule.

2.04 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.
   1. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.
   1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Plywood backing: Behind all wood panels in lieu of gypsum board. See Section 06 10 00.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

2.05 FABRICATION

A. Fabricators: Subject to compliance with requirements, provide finish carpentry by the following:
   1. LTF Millwork, 4200 Norex Drive, Chaska, MN 55318. Phone: (952) 229-7647, Fax: (952) 477-5972.

B. Back out or kerf backs of the following members except those with ends exposed in finished work:
   1. Interior standing and running trim except shoe and crown molds.
   2. Wood board paneling.

C. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.03 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
   3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

3.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
   1. Match color and grain pattern across joints.
   2. Install trim after gypsum board joint finishing operations are completed.
   3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
   4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

3.05 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch (6-mm) gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
   1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
   2. Conceal fasteners to greatest practical extent.

3.06 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.07 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.08 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 06 20 01
FINISH CARPENTRY SCHEDULE

PART 1 GENERAL

PART 2 PRODUCTS

2.01 MATERIALS

A. MDF-1
   1. Manufacturer: Soelberg Industries
   2. Collection: Colonna
   3. Finish: Umbra Matte
   4. Core: 3/4” MDF Core
   5. Size: 48” x 96”
   6. Vendor: Soelberg Industries
      a. Contact name: Ryan Colvin
      b. Phone: 952-913-8822
      c. Email: ryan@soelbergi.com
   7. URL: https://soelbergi.com/3d-wall-panels/colonna/

END OF SECTION

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SECTION 06 40 00
ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Wood cabinets.
   2. Hardware.
   3. Plastic-laminate countertops.
   4. Shop finishing of interior woodwork.
   5. Millwork Trim.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 06 10 00 - Rough Carpentry.

E. Section 06 20 00 - Finish Carpentry.

F. Section 06 40 01 - Architectural Woodwork Schedules.

G. Section 09 75 00 - Interior Stone.

H. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. AHA A135.4 American Hardboard Association; Basic Hardboard.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

D. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).

E. AWI (QCP) - Quality Certification Program; Current Edition.

F. AWI/AWMAC/WI - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

H. ASLS DOC PS 20 American Softwood Lumber Standard.

I. AWPA U1 User Specification for Treated Wood.

J. NEMA LD 3 ANSI/NEMA Standard for High Pressure Laminates.

1.04 DEFINITIONS

A. Architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.

B. Product Data: For high-pressure decorative laminate and adhesive for bonding plastic laminate.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm), for each species and cut, finished on 1 side and 1 edge.
2. Veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Plastic laminates, 8 by 10 inches (200 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.

E. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Woodwork Quality Standard Compliance Certificates: AWI (QCP) Quality Certification Program certificates.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI (QCP) Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI "Architectural Woodwork Quality Standards" for grades of architectural woodwork indicated for construction, finishes, installation, and other requirements.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.07 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.

1.08 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. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity at occupancy levels during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements.

Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.09 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 PRODUCTS

2.01 WOODWORK FABRICATORS

A. Cabinet Fabricators: Subject to compliance with requirements, provide architectural woodwork by the following:
   1. LTF Millwork, 4200 Norex Drive, Chaska, MN 55318. Phone: (952) 229-7647, Fax: (952) 477-5972.
   2. Approved Equal.

2.02 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Maple, Select White, plain cut.

C. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   3. Softwood Plywood: DOC PS 1.
   4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
      a. Manufacturer: Subject to compliance with requirements, provide veneer-faced panel by one of the following:
         1) Dooge Veneers, 485 Airwest, SE, Grand Rapids, MI 49512. Telephone: 616.698.6540.
         2) RS Bacon Veneer Company, 100 South Mannheim Road, Hillside, IL 60162. Telephone: 708.547.6673

D. Wood Veneers & Stains:
   1. See attached Schedule.

E. High-Pressure Decorative Laminate:
   1. See attached Schedule.

F. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick, unless otherwise indicated.

G. Permalam, Almond Melamine at Cabinet Interior.

2.03 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."
   1. Refer to Millwork for casework hardware materials.

2.04 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. 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.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Contact cement.

2.05 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. Fabricate woodwork to dimensions, profiles, and details indicated.

D. 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.

E. 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. Seal edges of openings in countertops with a coat of varnish.

F. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.06 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Wood Species and Cut for Exposed Surfaces: Maple, plain sliced.
   1. Grain Direction: Horizontally for drawer fronts, doors, and fixed panels.
   2. Matching of Veneer Leaves: Slip match.
   3. Vertical Matching of Veneer Leaves: End match.
   4. Veneer Matching within Panel Face: Running match.
   5. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.

2.07 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Premium.

B. High-Pressure Decorative Laminate Grade: HGP.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Solid colors, matte finish.
   2. Solid colors with core same color as surface, matte finish.
   3. Wood grains, matte finish.
   4. Patterns, matte finish.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

E. Core Material: Particleboard or medium-density fiberboard.

F. Core Material at Sinks: Particleboard made with exterior glue.

G. Paper Backing: Provide paper backing on underside of countertop substrate.

2.08 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. Transparent Finished Millwork:

1. Shop apply the prime coat including back-priming, if any, for transparent-finished items specified to be field finished. Refer to Division 9 painting Sections for material and application requirements.
2. 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.
    a. Back-priming: 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 back-priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
3. Transparent Finish:
    a. Grade: Premium.
    b. AWI Finish System: TR-6, Catalyzed polyester.
    c. Staining: Match approved sample for color.
    d. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
        1) Apply wash-coat sealer after staining and before filling.
    e. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

D. Painted Millwork:
1. Prime coat and first paint coat shall be shop applied.
2. Final coats to be field applied by painter.
3. See Section 09 91 00 - Painting.

PART 3 EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. 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 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

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. Cabinets: 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 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to walls with adhesive.

3. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 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.

END OF SECTION

SECTION 06 40 01
ARCHITECTURAL WOODWORK SCHEDULES

PART 1 GENERAL

PART 2 PRODUCTS

2.01 MATERIALS

A. Wood Veneers & Stains:
   1. VN-13
      a. Manufacturer: By owner's millwork vendor
      b. Species: Walnut
      c. Stain: Custom stain to match PLAM-34.
      d. Location: Flush Wood Doors, Locker room benches

B. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
      a. PLAM-19:
         1) Manufacturer: Wilsonart
         2) Collection: Fine Velvet Texture Finish
         3) Color: Neowalnut 7991-38
         4) Location: Toilet Partitions
         5) URL: https://www.wilsonart.com/neowalnut-7991-8994c244f80553bd89a07a29115f812d
      b. PLAM-33:
         1) Manufacturer: Wilsonart
         2) Collection: Contract Collection
         3) Color: Natural Almond
         4) Location: Interior finish of select LTKA casework
         5) URL: https://www.wilsonart.com/natural-almond-d30
      c. PLAM-34:
         1) Manufacturer: Egger
         2) Color: #H3710-ST22 Natural Carini Walnut
         3) Finish: ST22-Textured Finish
         4) Location: Millwork Throughout, UNO
         5) URL: https://www.egger.com/shop/en_US/interior/decor-detail/H3710_12

END OF SECTION

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SECTION 06 64 00
PLASTIC PANELING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes glass-fiber reinforced plastic wall paneling and trim accessories and Thermoplastic Resin Panels.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 06 20 00 - Finish Carpentry.

E. Section 06 40 00 - Architectural Woodwork.

F. Section 06 64 01 - Plastic Panelling - Schedules.

G. Section 09 21 16 - Gypsum Board Assemblies.

H. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 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: UL.

1.06 PROJECT CONDITIONS

A. 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.

PART 2 PRODUCTS

2.01 PLASTIC SHEET PANELING

A. Surface Burning Requirements, Interior Use: Flame spread index of 25 or less and smoke-development index of 450 or less; Class A classification when tested in accordance with ASTM E84.

B. Applicable panels must comply with the requirements of ASTM D5319.

C. See attached Schedule.

2.02 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. 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.

C. Adhesive: As recommended by plastic paneling manufacturer.
   1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 7 Section "Joint Sealants."
   1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, 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.

3.02 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

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 to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at panel joint locations for accurate installation.
   2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.03 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. Do not fasten through panels.

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.

G. Resin panels may be set in the storefront frame by excluding the glazing gasket and securing with sealant.

END OF SECTION

SECTION 06 64 01
PLASTIC PANELING SCHEDULE

PART 1 GENERAL

PART 2 PRODUCTS

2.01 PLASTIC SHEET PANELING

A. FRP-1: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Glasbord by Crane Composites.
      b. Marlite
      c. Nudo Products, Inc
   2. Nominal Thickness: Not less than 0.09 inch (2.3 mm)
   3. Fire resistance: Provide Class C panels in sprinklered areas, Class A where there are no fire sprinklers.
   4. Height: Ten foot panels
   5. Surface Finish: Molded pebble texture
   6. Color: White

PART 3 EXECUTION

END OF SECTION

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SECTION 07 00 10
DIVISION 7 TABLE OF CONTENTS

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 08 00 - Commissioning of Thermal and Moisture Protection
07 14 50 - Fluid Applied Waterproofing Membrane
07 18 00 - Traffic Coatings
07 21 00 - Thermal Insulation
07 24 19 - Water-Drainage Exterior Insulation and Finish System (EIFS)
07 27 01 - High Performance Vapor Barrier
07 27 26 - Fluid-Applied Membrane Air Barrier
07 42 00 - Metal Wall Panels
07 54 23 - Thermoplastic Polyolefin (TPO) Roofing
07 62 00 - Sheet Metal Flashing and Trim
07 72 33 - Roof Hatches
07 81 00 - Applied Fireproofing
07 84 00 - Firestopping
07 92 00 - Joint Sealants
07 95 00 - Preformed Traffic Durable Sealant Systems

END OF SECTION

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SECTION 07 08 00
COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

C. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

D. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

E. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Fluid Applied Waterproofing Membrane
   2. Thermal Insulation
   3. Exterior Insulation and Finish System
   4. Fluid-Applied Membrane Air Barrier
   5. Metal Wall Panels
   6. Thermoplastic Polyolefin Roofing
   7. Sheet Metal Flashing and Trim
   8. Applied Fireproofing
   9. Board Fireproofing
   10. Fire Stopping
   11. Joint Sealants
   12. Expansion Joint Systems

END OF SECTION

SECTION 07 13 26
PRE-APPLIED SHEET MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. The Work of this Section includes, but is not limited to, pre-applied sheet membrane waterproofing that forms an integral bond to poured concrete for the following applications:
   1. Elevator Pits:
      a. Vertical Applications: Membrane applied against soil retention system prior to placement of concrete foundation walls.
      b. Horizontal Applications: Membrane applied on prepared subbase prior to placement of concrete slabs.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 20 00 - Concrete Reinforcing.

E. Section 03 30 00 - Cast-In-Place Concrete.

F. Section 07 14 50 - Fluid Applied Waterproofing Membrane.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data.

B. Manufacturer's installation instructions.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.04 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

D. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

F. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2020.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

H. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2019).

1.05 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of sheet membrane waterproofing.

Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer: A firm which has at least 5 years successful experience in work of the type required by this section and must be familiar with the proper installation techniques and requirements for the specified membranes.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

E. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

1.07 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.08 WARRANTY

A. Sheet Membrane Waterproofing: Provide written five year material warranty issued by the membrane manufacturer upon completion of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Approved Manufacturers and Products:
1. GCP Preprufe 300R/160R Plus.
2. Polyguard Products Inc, Blindside Waterproofing Membrane.
3. AVM Industries, Aussie Skin 550G.
4. Or approved equal.

B. Horizontal Application: Pre-Applied Integrally Bonded HDPE Sheet Waterproofing Membrane for vertical or horizontal application: Membrane for application temperatures between 25°F (-4°C) and 95°F (+35°C)] , a 1.2mm (0.046 in) nominal thickness composite sheet membrane consisting of 0.8 mm (0.030 in.) of high density polyethylene film, a pressure-sensitive adhesive and a trafficable weather resistant coating. The membrane shall be supplied in a kick-out roll orientation and shall have no release liner to reduce waste onsite. The membrane shall form an integral, adhesive and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete and shall include dual adhesive seam to complete side laps and secure adjacent sheets. Provide membrane with the following physical properties:

1. Minimum Physical Properties of Horizontal Membrane:

Property	Test Method	Typical Value
Lateral Water Migration Resistance	ASTM D5385/D5385M	Pass at 231 ft (71m) of hydrostatic head pressure
Low Temperature Flexibility	ASTM D1970/D1970M	Unaffected at -20°F (-29°C)
Resistance to Hydrostatic Head	ASTM D5385/D5385M Modified 2	230 ft (71m)

Elongation	ASTM D412 Modified 3	400%
Tensile Strength, film	ASTM D412	4,000 psi (27.6 MPa)
Crack Cycling at -9.4°F (-23°C), 100 Cycles	ASTM C836/C836M	Unaffected, Pass
Puncture Resistance	ASTM E154/E154M	200 lbs (890 N)
Peel Adhesion to Concrete	ASTM D903 Modified 4	5.0 lbs/in. (880 N/m)
Lap Peel Adhesion	ASTM D1876 Modified 5	8.0 lbs/in. (1408 N/m)
Permeance to water vapor transmission	ASTM E96/E96M Method B	0.01 perms (0.6 ng/Pa x s x m2)

C. Vertical Application: Pre-applied Integrally Bonded HDPE Sheet Waterproofing Membrane, a 0.8 mm (0.032 in) min nominal thickness composite sheet membrane consisting of a 0.4 mm (0.016 in.) of high density polyethylene film, a pressure-sensitive adhesive and a trafficable weather resistant coating. The membrane shall form an integral, adhesive and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete and shall include dual adhesive seam to complete sidelaps and secure adjacent sheets. Provide membrane with the following physical properties:

1. Physical Properties for Vertical Membrane:
    a. Minimum Physical Properties of Vertical Membrane:

PROPERTY	TEST METHOD	TYPICAL VALUE
LATERAL WATER MIGRATION RESISTANCE	ASTM D5385/D5385M MODIFIED 1	PASS AT 231 FT (71M) OF HYDROSTATIC HEAD PRESSURE
LOW TEMPERATURE FLEXIBILITY	ASTM D1970/D1970M	UNAFFECTED AT -20°F (-29°C)
RESISTANCE TO HYDROSTATIC HEAD	ASTM D5385/D5385M MODIFIED 2	231 FT (71M)
ELONGATION	ASTM D412 MODIFIED 3	400%
TENSILE STRENGTH, FILM	ASTM D412	4,000 PSI (27.6 MPA)
CRACK CYCLING AT -9.4°F (-23°C), 100 CYCLES	ASTM C836/C836M	UNAFFECTED, PASS
PUNCTURE RESISTANCE	ASTM E154/E154M	100 LBS (445 N)
PEEL ADHESION TO CONCRETE	ASTM D903 MODIFIED 4	5.0 LBS/IN. (880 N/M)
LAP PEEL ADHESION	ASTM D1876 MODIFIED 5	8.0 LBS/IN. (1408 N/M)
PERMEANCE TO WATER VAPOR TRANSMISSION	ASTM E96/E96M METHOD B	0.01 PERMS (0.6 NG/PA X S X M2)

2.02 ACCESSORIES

A. Note: ensure all accessories are approved for use in the project conditions and climate by the Manufacturer

B. Waterstop: Hydrophilic waterstop or tube groutable waterstop by membrane Manufacturer for non-moving concrete construction joints.

C. Preformed Soil Retention Wall Tieback Cover: By Manufacturer as a prefabricated detail for soil retention wall tiebacks.

D. Tape for covering cut edges, roll ends, penetrations and detailing: By Manufacturer

E. Miscellaneous Materials: Accessories specified or acceptable to manufacturer of pre-applied waterproofing membrane.

PART 3 EXECUTION

3.01 EXECUTION

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the Contractor, in writing, of circumstances detrimental to the proper completion of the work.

B. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 SUBSTRATE PREPARATION

A. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability.
   1. Horizontal Surfaces - The substrate must be free of loose aggregate and sharp protrusions.
      a. Avoid curved or rounded substrates.
      b. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour.
      c. Remove standing water.
   2. Vertical Surfaces - Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

3.03 INSTALLATION, HORIZONTAL APPLICATIONS

A. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:
   1. Place the membrane HDPE film side to the substrate with the green zip strip facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers.
   2. Leave the backside zip strips in position until the overlap procedure is completed and the lap is to be made.
   3. Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.
   4. Peel back and remove protective strips in the overlap area to achieve an adhesive to adhesive bond while ensuring proper overlap.
   5. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.
   6. Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary.
   7. Allow to dry and apply tape centered over the lap edges and roll firmly. Apply additional tape a minimum of 2 in. beyond all edges of membrane that are not sealed by the selvedge.
   8. Construction joint optional detailing:
      a. Center PREPRUFE® CJ Tape LT (or HC in hot climates) at all concrete construction joints and adhere the PREPRUFE® CJ Tape to the top of pre-applied waterproofing membrane.
      b. Immediately remove tinted plastic release liner from the PREPRUFE® CJ Tape.

3.04 INSTALLATION, VERTICAL APPLICATIONS

A. Strictly comply with installation instructions in manufacturer's published literature, including but not limited to, the following:
   1. Place the membrane HDPE film side to the substrate with the green zip strip facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers.
   2. Leave the green and blue zip strips in position until the overlap procedure is completed and the lap is to be made.
   3. Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge with a red guideline. The blue zip strip on the underside of the succeeding membrane shall be positioned on top of the green zip strip on the top of the previous sheet. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap.

4. Peel back and remove both the green and blue zip strips in the overlap area to achieve an adhesive to adhesive bond, lining up leading edge of the top sheet with the red guideline.
5. For lengths of membrane greater than 8 ft. (2.4 m), mechanically fasten the membrane at 2 ft. (0.6 m) intervals in the self-adhesive selvedge ½ in. (12 mm) from outside edge prior to overlapping succeeding sheet. Fastener type is substrate dependent but fastener head shall have small diameter and low-profile.
6. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.
7. Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary.
8. Allow to dry and apply PREPRUFE® Tape LT (or HC in hot climates) centered over the lap edges and roll firmly. Apply additional PREPRUFE® Tape LT (or HC in hot climates) a minimum of 2 in. beyond all edges of membrane that are not sealed by the selvedge.
9. Immediately remove tinted plastic release liner from the PREPRUFE® Tape.
10. Construction joint optional detailing:
    a. Center PREPRUFE® CJ Tape LT (or HC in hot climates) at all concrete construction joints and adhere the PREPRUFE® CJ Tape to the top of pre-applied waterproofing membrane.
    b. Immediately remove tinted plastic release liner from the PREPRUFE® CJ Tape.

3.05 INSTALLATION, ROLL ENDS AND CUT EDGES

A. Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary.

B. Allow to dry and apply PREPRUFE® Tape LT (or HC in hot climates) centered over the lap edges and roll firmly.

C. Immediately remove printed plastic release liner from the PREPRUFE® Tape.

3.06 PROTECTION

A. Protect membrane in accordance with manufacturer’s recommendations until placement of concrete. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer’s recommendation

END OF SECTION

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SECTION 07 14 50
FLUID-APPLIED WATERPROOFING MEMBRANE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Surface preparation of concrete surfaces, sealing of form ties, cracks, and joints for installation of fluid-applied waterproofing membrane.
   2. Provide fluid-applied waterproofing membrane, applicable sealants, drainage, and elastomeric flashings needed to prevent water penetration at locations indicated.
   3. Provide insulation board for protection of waterproofing membrane from damage during backfill.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast-In-Place Concrete.

E. Section 04 20 00 - Unit Masonry.

F. Section 06 10 00 - Rough Carpentry.

G. Section 07 21 00 - Thermal Insulation.

H. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.

I. Section 07 62 00 - Sheet Metal Flashing and Trim.

J. Section 07 92 00 - Joint Sealers.

K. Section 09 21 16 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C836/C836M Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course

B. ASTM C920 Standard Specification for Elastomeric Joint Sealants.

C. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

D. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials.

E. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems.

1.04 LOCATIONS

A. Along Perimeter of building foundation walls, See Details.

B. Along backside of foundation walls, below elevation 100’- 0”, of Elevator Pit. Extend onto horizontal footing as shown on the drawings.

C. Along backside of foundation walls, below elevation 100”- 0”, of pool pump pits. Extend onto horizontal footing as shown on the drawings.

1.05 SUBMITTALS

A. Material and Equipment Submittals:
   1. Product Data: Submit fluid-applied waterproofing membrane and insulation board manufacturer's technical data.
   2. Samples: Submit samples of sealant colors for color selection.
   3. Submit the results of the on-site adhesion testing. (Perform project specific adhesion testing of the water proofing membrane for all surfaces to receive membrane)
   4. Site visit report from the waterproofing manufacture stating that they visited the site and inspected the substrates to receive new waterproofing and they found they are acceptable substrates.

B. Compatibility Letters:
   1. Submit letters from the Manufacturer ensuring compatibility with adjacent materials, including Air Barrier, sealants, etc.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Closeout Submittals:
   1. Warranty. See below.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installers: Submit written statement from manufacturer that installer is certified to install the product.

C. Source limitations: All materials installed as part of waterproofing system shall be obtained from a single manufacturer, or consist of products certified by manufacturer as compatible.

D. Pre-Construction Conferences. The manufacturer will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the waterproofing assembly.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in manufacturer’s unopened containers with all labels intact and legible at time of use.

B. Maintain the products in accord with manufacturer’s recommendations with proper precautions to ensure fitness of materials when installed.

C. Protect waterproofing materials from freezing prior to application. Store material above 50 degrees.

D. Store rigid drainage, protection and insulation board flat and off the ground. Provide cover on top and on all sides.

1.08 SUBSTRATE CONDITIONS

A. General:
   1. Provide surfaces that are broom clean, dry, sound and free of voids, bug holes, rock pockets, honeycombs, protrusions, excessive roughness, foreign matter, frost, ice and other contaminants which may inhibit application or performance of the waterproof membrane system.
   2. Using suitable abrasive methods, remove residue of form release, curing compound, chemical retarders and other surface treatments, laitance, mortar smear, saw cutting residue, mill scale, rust, loose material and other contaminants from concrete, masonry and ferrous metal surfaces to receive the work of this Section.

B. Concrete: Where work of this Section will be applied to concrete, provide surfaces that are smooth finish equal to one that is light steel troweled followed by a fine hair broom.

1.09 WARRANTY

A. Deliver to the Architect signed copies of the following written warranties against defective materials and workmanship for a period of two years following date of completion. Warrant that installed waterproofing membrane system shall be free of defects including adhesive failure, cohesive failure, and waterproofing failure resulting from substrate cracking up to 1/16 inch.
   1. Manufacturer’s standard warranty covering materials.
   2. Applicator’s standard warranty covering workmanship.

PART 2 PRODUCTS

2.01 MATERIALS

A. Single Source and compatibility requirements:

1. Provide all components of the waterproofing system from a single source, with all components recommended by the Manufacturer for the application.
2. Provide products that are certified by their Manufacturers to be compatible with adjacent materials.

B. Fluid-Applied Waterproofing Membrane, single component, Water based, polymer-modified asphalt emulsion. Acceptable Manufacturers and Products:
1. Tremco: TREMproof 260 or 250GC.
2. W.R. Meadows: MEL-ROLL LM
3. Mar-Flex: ArmorMembrane 363
4. Or approved equal.

2.02 ACCESSORIES

A. Joint Backing: Closed-cell, polyethylene rod as recommended by membrane manufacturer.

B. Joint Treatment: Provide a multi-component, chemically curing polyurethane sealant that is compatible with the provided membrane and recommended by its Manufacturer as being suitable for the application.
1. Primer for sealant: Prime surface as recommended by the sealant manufacture.

C. Rigid Drainage, Protection, and Insulation Board:
1. Dow Protection Board III.
2. Or approved equal.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Applicator shall examine areas and conditions under which Work of this Section will be performed:
1. Verify conformance with manufacturer's requirements. Manufacture representative to visit site and approve prepared substrate. Letter from manufacture to be provided stating such.
2. Report unsatisfactory conditions in writing to the Architect.
3. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Surface preparation and detailing procedures to be in accordance with waterproofing membrane system manufacturer's instructions and recommendations except where more stringent requirements are indicated.

B. On poured concrete walls, remove wall ties on outside and inside of wall. On poured concrete walls, tie holes and other voids, rock pockets, etc. shall be patched with a non-shrinking grout.

C. Clean surfaces to receive membrane system in accordance with manufacturer's instructions; vacuum clean or blow clean with oil-free compressed air all surfaces to receive sealants, detailing materials or membranes immediately prior to installation.

D. Rout, clean, prepare and detail surface cracks in accordance with manufacturer's instructions; install backer rod where required.

E. Install detail coats, joint and crack treatments, and liquid flashings in accordance with manufacturer's instructions.

F. Allow detail applications to cure in accordance manufacturer's instructions prior to general application of membrane.

3.03 APPLICATION

A. General: Install waterproofing system in accordance with manufacturer's recommendations and instructions as applies to the Work except where more stringent requirements are indicated.
1. Waterproofing membrane shall have a 60 mil wet film thickness for vertical surfaces and 90 mil wet film thickness for horizontal surfaces.

B. Verify proper dry condition of substrate using method recommended by membrane system manufacturer; perform adhesion checks prior to general application of membrane system using field adhesion test method recommended by the manufacturer. Submit adhesion test results as called out in section 1.3 Part 3 of this specification section.

C. Mask off adjoining surfaces not to receive membrane system.

D. Clean all detail coats of Waterproof system from previous days' work with mineral spirit wipe. Wipe clean all other detail coats with Xylene solvent wipe; do not saturate detail coats. Overlap existing work by 6" with new work.

E. Apply membrane uniformly and allow cure in accord with manufacturer's instructions.

F. Tool joints to form smooth, uniform beads, with slightly concave surfaces. Do not use tooling agents, unless specifically recommended by sealant manufacturer.

G. Install protection course (drainage) over cured membrane in accordance with manufacturer's instructions.

3.04 PROTECTION AND CLEAN-UP

A. Promptly remove material of membrane system material from adjacent surfaces which will be exposed in the completed work. Leave work area in broom clean condition.

B. Prohibit traffic over completed work and against work overhead until protection course is installed; protect from damage until protected beneath overlaying work.

END OF SECTION

SECTION 07 18 00
TRAFFIC COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waterproof coatings for traffic surfaces.
   1. TC-1: Epoxy Coating system.
   2. TC-2: Polyurethane Coating system.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast-in-Place Concrete.

E. Section 09 05 61 - Common Work Results for Flooring Preparation.

F. Section 09 65 19 - Resilient Tile Flooring.

G. Section 09 67 23 - Resinous Flooring

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

C. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

F. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

G. ICC-ES AC39 - Acceptance Criteria for Walking Decks; 2017, with Editorial Revision (2020).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with Mechanical, Electrical and Aquatics.
   1. Sequence Traffic coating installation such that it is installed after the pouring of housekeeping pads and before floor mounted equipment in all areas to receive the coating.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Include product characteristics and limitations. Identify dissolving solvents, fuels, and potential destructive compounds.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Manufacturer's Installation Instructions: Include special field conditions required to install traffic membrane and potential incompatibilities with adjacent materials.

E. Maintenance Data: Include procedures for stain removal, repairing surface, and cleaning.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

C. Applicator Qualifications: Company specializing in performing installation of traffic membrane, with minimum 3 years documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Maintain storage area at minimum ambient temperature of 55 degrees F (13 degrees C).

B. Keep away from fire or open flame.

1.08 FIELD CONDITIONS

A. Do not install materials when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during and 72 hours after application.

C. Restrict traffic from area where materials are being installed or are curing.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 TRAFFIC COATINGS

A. **[TC-1]** Epoxy Coating System: 2-component, water based, epoxy-polyamide coating for concrete floors. VOC content, 121 g/L. Total Solids Content: 56 percent. Dry Film Thickness: 3-4 mils (76-102 microns) per coat. Apply 2 coats.
   1. Manufacturer/Product:
      a. The Euclid Chemical Co., Eucopoxy Tufcoat VOX.
      b. Or approved equal.
   2. Non-Slip Aggregate Finish:
      a. Washed, dry, 70-90 mesh silica sand evenly into first coat.
   3. Finish: Smooth, semi-gloss.
   4. Color: As selected by Architect.

B. **[TC-2]** Pedestrian Polyurethane Waterproof Coating System: Fluid applied 2-part polyurethane system with base and top coat.
   1. Manufacturers/Product:
      a. Tremco Commercial Sealants & Waterproofing; Vulkem 350NF/351: www.tremcosealants.com/#sle.
      b. Or approved equal.
   2. Finished Coating Thickness: 48 mil, 0.048 inch (1.21 mm), minimum.
   3. Finish: Manufacturer's standard aggregate finish; particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.
   4. Color: As selected by Architect.

2.02 ACCESSORIES

A. Surfacing: Clean sand.

B. Filler and Primer: As recommended by membrane manufacturer.

C. Cant Strips: 1 inch by 1 inch (25.4 mm by 25.4 mm) by 45 degrees, of dense sponge rubber compatible with adjacent materials.

D. Sealant: As recommended by membrane manufacturer, and compatible with system and adjacent materials.

2.03 LIQUID SEALER / DENSIFIER

A. Silicone based sealer what penetrates concrete surfaces, and provides a "low-sheen" surface that is easy to clean and eases the problem of tire mark removal. Minimum solids content of 20%, with 50% siliconate.

B. Manufacturer/Product:
   1. Euclid Chemical Co., "Euco Diamond Hard".
   2. Substitutions: In accordance with Division 1 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is ready to receive work, surface is clean, dry and free of substances that could adversely effect bond.

B. Do not begin work until concrete substrate has cured at least 28 days and moisture content is 16 percent or less.

C. Test concrete surfaces according to ASTM F710 for acceptable level of alkalinity.

3.02 PREPARATION

A. Clean substrate surface free of foreign matter.

B. Patch wood substrate with latex filler to produce surface conducive to bond.

C. Patch concrete substrate with filler to produce surface conducive to bond.

D. Install cant strips securely at intersecting surfaces.

E. Protect adjacent surfaces.

3.03 INSTALLATION

A. Apply system materials in accordance with manufacturer's instructions.

B. Transitions to other floor finishes, where no other transition is indicated:
   1. Where traffic coating terminates at sealed concrete floor: feather coating to level of concrete.
   2. Where traffic coating terminates at finishes of greater thickness (i.e. Tile): Slope coating to level of finish by adding sand to mixture.
      a. Max slope 1/4" per foot.
      b. See manufacturer's instructions for proportion of sand to mix.

C. Finish to smooth surface sloped to drains.

D. Cove and omit aggregate at vertical surfaces.
   1. Where base is indicated, provide coved, 6" high base. See Finish Plans.

E. Apply surfacing to top coat before set.

F. Apply sealant to junction of horizontal and intersecting surfaces to achieve watertight seal.

3.04 PROTECTION

A. Do not permit traffic over unprotected surfaces.

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Extruded Polystyrene Board insulation. (XPS) (INSUL-1)
      a. High strength Extruded Polystyrene Board. (INSUL-1A)
   2. Unfaced blanket/batt insulation. (INSUL-2)
   3. Sound attenuation Insulation. (INSUL-3)
   4. Faced/Unfaced Board insulation. (INSUL-4)
   5. Foil-Faced/ Fiber-Faced, Polyisocyanurate Board Insulation. (INSUL-5)
   6. Spray polyurethane foam insulation. (INSUL-6)
   7. High-Temp spray polyurethane foam insulation. (INSUL-7)
   8. Semi-Rigid mineral wool fiber batt insulation. (INSUL-8)
   9. Expanded Polystyrene Insulation (EPS or Geofoam). (INSUL-10)

B. See Section 07 24 19 - for EIFS insulation.

C. See Section 07 54 23 - for Roofing insulation.

D. See Section 22 07 00 - for Plumbing insulation.

E. See Section 23 07 00 - for HVAC insulation.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast in Place Concrete.

E. Section 04 20 00 - Unit Masonry.

F. Section 07 24 19 - Water Drainage Exterior Insulation and Finish System.

G. Section 07 42 00 - Metal Wall Panels.

H. Section 07 54 24 - Thermoplastic Polyolefin (TPO) Roofing.

I. Section 07 81 00 - Applied Fireproofing.

J. Section 22 07 00 - Plumbing Insulation.

K. Section 23 07 00 - HVAC Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation; Current Edition.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

F. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation; 2020.

G. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

H. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

I. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.

J. ASTM D6817/D6817M - Standard Specification for Rigid Cellular Polystyrene Geofoam; 2017 (Reapproved 2021).

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

L. D7180/D7180M - Standard Guide for Use of Expanded Polystyrene (EPS) Geofoam in Geotechnical Projects; 2013.

M. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.05 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 30 00:
   1. Manufacturer's installation instructions.
   2. Product Data: Submit product data for each type of insulation required.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.06 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics:
   1. Comply with applicable codes for Class I (Class A) flame/smoke ratings of 25 or less/450 or less for insulation types and accessories other than foamed plastic; when tested according to ASTM E84 (UL 723).
   2. Comply with applicable codes for Class II (Class B) flame/smoke ratings of 75 or less/450 or less for foamed plastic insulation types; when tested according to ASTM E84 (UL 723).
   3. Provide minimum of 2 year workmanship warranty for all work included in Section 07 21 00.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. INSUL-1: Extruded Polystyrene Board Insulation: ASTM C578, Type IV, extruded cellular polystyrene; 1.6 pcf density minimum; 25 psi minimum compressive strength; 0.3 percent maximum water absorption by volume; "k" factor of 0.20 at 75 deg. F; square edges, manufacturer's standard board sizes.
   1. 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:
      a. DiversiFoam Products, Certifoam 25 SE.
      b. Dupont, Square Edge.
      c. Owens Corning, Foamular 250.
      d. Ox Engineered Products: Ox ISO Red Max Polyisocyanurate
      e. Or approved equal.
   2. R-Value 5/inch.
   3. Thickness: Unless thickness is specifically noted on drawings, provide minimum R-value as defined by local energy code.

B. INSUL-1A: High Load Extruded Polystyrene Board Insulation: ASTM C578, Type VII, extruded cellular polystyrene; 1.6 pcf density minimum; 60 psi minimum compressive strength; 0.1 percent maximum water absorption by volume; "k" factor of 0.20 at 75 deg. F; square edges, manufacturer's standard board sizes.
   1. 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:
      a. DiversiFoam Products, Certifoam 60.
      b. Dupont, Styrofoam Highload 60.
      c. Owens Corning, Foamular 600.
      d. Or approved equal.
   2. R-Value 5/inch.
   3. Thickness: Unless thickness is specifically noted on drawings, provide minimum R-value as defined by local energy code.

C. INSUL-2: Glass Fiber Blanket/Batt Insulation (Unfaced): ASTM C665, Type I, preformed glass fiber blanket without facers.
   1. 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:
      a. CertainTeed Corporation, Unfaced Building Insulation.
      b. Johns Manville, Cavity-Shield Unfaced Insulation Blankets.
      c. Owens-Corning Fiberglass Corp., Unfaced Glass Fiber Insulation.
      d. Or approved equal.
   2. R-value: 3.2/inch.
   3. Thickness: Provide minimum R-value of 13 where insulation is used in metal stud framed portions of the exterior wall.

D. INSUL-3: Sound Attenuation Insulation: ASTM C665, Type I, semi-rigid glass fiber blanket, thickness to fill cavity space.
   1. Johns-Manville, JM unfaced Batts.
   2. Owens-Corning Corp, EcoTouch Sonobatts.
   3. Certainteed, Noise Reducer.
   4. Or approved equal.

E. INSUL-4: Glass Fiber Board Insulation: ASTM C612, Form A, Class 1, semi-rigid glass fiber type; density of 2.25 pcf, faced one side with mesh reinforced aluminum foil; square edges. Thickness as indicated on Drawings.
   1. Johns Manville Wall Insulation, FSK 25.
   2. Knauf, Insulation Board, FSK Facing.
   3. Owens-Corning, Flame Spread 25 nsulation.
   4. Or approved equal.

F. INSUL-5: Foil-Faced/Fiber-Faced, Polyisocyanurate Board Insulation: ASTM C1289, Type I, Class 1, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
   1. 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:
      a. Atlas Roofing Corporation, EnergyShield.
      b. Johns-Manville, AP Foilfaced.
      c. Rmax, Inc, Thermasheath-3.
      d. Or approved equal.
   2. R-value: 6.5/inch.
   3. Thickness: Unless thickness is specifically noted on drawings, provide minimum R-value as follows:
      a. Where insulation is applied directly to the primary concrete structure of the exterior wall: 9.5
      b. Where insulation is applied to metal stud framed portions of the exterior wall: 13.

G. INSUL-6: Spray Polyurethane Foam Insulation: Closed-Cell Polyurethane Foam Insulation: ASTM C1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
   1. 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:
      a. BASF Corporation.
      b. Dow Chemical Company (The).
      c. Henry Company.
      d. NCFI; Division of Barnhardt Mfg. Co.
      e. SWD Urethane Company.
      f. Volatile Free, Inc.
   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).
   3. Closed-Cell Spray-Foam product to achieve an aged R-value of 6.0 per inch.

H. INSUL-7: High Temperature Spray Polyurethane Foam Insulation: Rigid Closed-Cell Polyurethane Foam Insulation: ASTM C518, ASTM D1621 and ASTM D1622, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84. Passes High Temperature Surface performance per ASTM C411.
   1. 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:
      a. Basis of Design: Huntsman, "Heatlok High Temp".
      b. Dow Chemical Company.
      c. Henry Company.
      d. Or approved equal.
   2. Compressive Strength: Minimum 38 psi.
   3. Thermal Resistivity: Minimum 7 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).
   4. Density: Minimum 2.5 lb/cft.

I. INSUL-8: Mineral Wool Fiber Blanket/Batt Insulation: Non-Combustible, lightweight, foil faced semi-rigid mineral wool batt insulation; ASTM C612, Type IVB; Surface burning characteristics in accordance with ASTM E84, Class A; thermal requirements as indicated on drawings.
   1. Basis of Design: Rockwool “CavityRock".
   2. Acceptable Alternate Manufacturers: Subject to compliance with requirements specified, acceptable manufacturers are as follows:
      a. Johns Manville.
      b. Owens Corning/Thermafiber.
      c. Or approved equal.
   3. Color: Black or Dark Gray.
   4. R-value: 4.3/inch.

J. INSUL-10: Geofoam. Expanded Polystyrene (EPS).
   1. To comply with ASTM D6817/D6817M and D7180/D7180M, compressive resistance type indicated below nad with frlame spread index less than 25 and smoke developed index less than 450 per ASTM E84/ UL 723 .
   2. To be used as landscape/pool fill as shown on drawings.
   3. Compressive resistance:
      a. 60 psi min.

2.02 ACCESSORIES

A. Foil Tape: Flame retardant pressure-sensitive type recommended by insulation manufacturer for application, 2" wide minimum.

B. Adhesive: Type recommended by insulation manufacturer for application.

C. Impaling Pins: Impaling pins and locking washers as recommended by insulation manufacturer.

D. Smoke Seal Compound:
   1. Owen's Corning, Thermafiber Smoke Seal Compound.
   2. Or approved equal, see Section 07 84 00.

E. Thermal Barrier as noted in 07 81 00 for exposed spray polyurethane foam insulation.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation.

3.02 INSTALLATION - FOUNDATIONS

A. Install XPS insulation (INSUL-1) at foundation walls where indicated on drawings.

B. See below for required R-value.

3.03 INSTALLATION - EXTERIOR WALLS

A. Install polyiscyanurate (INSUL-5) boards with adhesive applied according to manufacturer's instructions where rigid insulation is called for.
   1. Tape all board transitions.

B. Install mineral wool (INSUL-8) at the following locations and where indicated on drawings.
   1. Spandrel Glass.

C. Total Exterior Opaque Envelope R-value: 13 (ICC (IECC) Table C402.1.3)

D. See Section 07 24 19 for EIFS.

3.04 INSTALLATION - BLANKET/BATT INSULATION

A. Install thermal batt insulation (INSUL-2) as shown on drawings, in accordance with manufacturer's instructions.

B. Install batt insulation in walls without gaps or voids.

C. Trim insulation neatly to fit spaces. Use batts free of damage.

D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

E. Fill cracks and voids around framing and blocking, other voids in exterior walls, and voids around wood cants, curbs, and blocking in and about the roof. Wedge in place, completely filling voids.

3.05 INSTALLATION - SOUND ATTENUATION INSULATION

A. Install sound attenuation insulation (INSUL-3) in partitions and ceilings according to manufacturer's instructions as indicated on the Drawings.

B. Where a room having ACT is indicated to receive Sound Attenuation Insulation above the ceiling, extend insulation at same depth,12" into adjacent rooms with ACT as well.

C. Do not install Sound Attenuation Insulation over light fixtures.

3.06 INSTALLATION - FIBERGLASS BOARD INSULATION (FACED AND UNFACED)

A. Install Fiberglass Board (INSUL-4) as indicated on Drawings and in accordance with manufacturer's instructions.

B. Install around hot/humid interiors. See details.

3.07 INSTALLATION - SPRAY-APPLIED INSULATION

A. Install standard Spray Applied Insulation (INSUL-6) and High Temperature Spray Applied Insulation (INSUL-7) as indicated on Drawings.

B. Clean and prime all substrates per manufacturer's recommendations prior to installation of spray polyurethane foam insulation. Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive

insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Spray Polyurethane Foam Insulation: Closed-Cell Polyurethane Foam Insulation.

D. Apply according to manufacturer's written instructions.
   1. High Temp Spray: Install within bench cavities and wherever else indicated on Drawings in manner to completely eliminate voids.

END OF SECTION

SECTION 07 24 19
WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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. EIFS-clad drainage-wall assemblies that are field applied over substrate.
   2. Water-resistive coatings.
   3. Accessory materials.

1.03 RELATED REQUIREMENTS:

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 45 33 - Code-Required Special Inspections and Procedures.

E. Section 01 60 00 - Product Requirements.

F. Section 01 77 00 - Closeout Procedures.

G. Section 01 92 00 - Facility Operation and Maintenance.

H. Section 04 20 00 - Unit Masonry Assemblies.

I. Section 05 40 00 - Cold-Formed Metal Framing.

J. Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

K. Section 07 21 00 - Thermal Insulation.

L. Section 07 27 26 - Fluid-Applied Membrane Air Barrier.

M. Section 07 62 00 - Sheet Metal Flashing and Trim.

N. Section 07 92 00 - Joint Sealants.

1.04 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. ICC (IBC): International Building Code.

1.05 REFERENCE STANDARDS

A. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

D. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2023.

E. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).

F. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; Current Edition.

G. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2022.

H. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2020.

I. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation; Current Edition, Including All Revisions.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

K. ASTM E2098 - Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution; Current Edition.

L. ASTM E2110 - Standard Terminology for Exterior Insulation and Finish Systems (EIFS); Current Edition.

M. ASTM E2359 - Standard Test Method for Field Pull Testing of an In-Place Exterior Insulation and Finish System Clad Wall Assembly; Current Edition.

N. ASTM E2511 - Standard Guide for Detailing of EIFS-Clad Barrier and Drainage Wall Assemblies; Current Edition.

O. ASTM E2568 - Standard Specification for PB Exterior Insulation and Finish Systems; Current Edition.

P. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007 (Reapproved 2019).

Q. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2022).

S. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

T. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.

U. NFPA 268 Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source.

V. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components.

W. AATCC 127-08 Water Resistance: Hydrostatic Pressure Test.

X. TT-S-001543A Sealing Compound: Silicone Rubber Base (for Calking, Sealing, and Glazing in Buildings and Other Structures)

Y. TT-S-00230 Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures.

1.06 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:
   1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
   2. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E2568.
      a. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category, Exposure Category, and Internal Pressure Coefficient indicated on Structural Drawings.
   3. Impact Performance: ASTM E2568, Standard impact resistance unless otherwise indicated.
   4. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested according to ASTM D968, Method A.
   5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D3274.

1.07 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Include representatives of the Manufacturer, the Applicator, substrate installers, the Owner and Construction Manager.

1.08 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each EIFS component, trim, and accessory, including water-resistive coatings.
   2. Samples: (2 ea) For each exposed product and for each color and texture specified, 8 inches (200 mm) square in size.
   3. 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 including custom trim, each profile.
   4. Shop Drawings: Show colors, profiles and details of each condition.

B. Informational Submittals:
   1. Qualification Data: For Installer.
   2. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:
      a. EIFS complies with requirements.
      b. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
      c. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
   3. Product Certificates: For cementitious materials and aggregates and for insulation and joint sealant, from manufacturer.
   4. Product Test Reports: For each EIFS assembly and component, and for water-resistive coatings, for tests performed by a qualified testing agency.
   5. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.
   6. Field quality-control reports and special inspection reports.
   7. Sample Warranty: For manufacturer's special warranty.

C. Mock-up:
   1. See 1.09 Quality Assurance and drawings for requirements of Mock Up.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Closeout Submittals:
   1. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.
   2. Submit an executed copy of the Exterior Insulation and Finish System with Moisture Drainage manufacturer’s comprehensive single source limited warranty.

1.09 QUALITY ASSURANCE

A. Manufacturer qualifications:
   1. Facility Certified by ANSI-RAB according to current ISO 9001 and ISO 14001.

B. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

C. Accessory materials manufacturer: Certified by EIFS manufacturer as producing materials compatible with EIFS.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, to test for compliance with specified requirements and to set quality standards for fabrication and installation.
   1. Mockups will be tested for compliance to the requirements of 1.06 Performance Requirements and according to the Commissioning Plan. See Section 01 92 00.

1.10 REGULATORY REQUIREMENTS

A. Separate the EPS insulation board from the interior of the building by a minimum 15-minute thermal barrier.

B. Comply with local building codes for the use and maximum thickness of EPS insulation board.

C. Cooperate with independent, third-party inspectors when required by code or contract documents.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Inspect all Exterior Insulation and Finish System with Moisture Drainage components and materials upon arrival for physical damage, freezing or overheating. Do not use questionable materials.

C. 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. Stack insulation board flat and off the ground.
   2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
   4. Minimize exposure of materials to temperatures over 90 °F (32 °C). Finishes exposed to temperatures over the published maximum storage temperature for even short periods may exhibit skinning and increased viscosity and shall be inspected prior to use.

1.12 FIELD CONDITIONS

A. Weather Limitations:
   1. Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied.
   2. Do not apply EIFS adhesives or coatings during rainfall.
   3. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.13 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Bond integrity and weathertightness.
      b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
   2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
      a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
      b. Insulation installed as part of EIFS including foam build-outs.
      c. Insulation adhesive and mechanical fasteners.
      d. EIFS accessories, including trim components and flashing.
      e. Water-resistive coatings.
      f. EIFS drainage components.
   3. Warranty Period: 12 (min) years from date of Substantial Completion.
      a. Obtain longer warranty period where qualified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide products by the following:
   1. Dryvit Systems, Inc.
      a. Outsulation.

B. Alternative manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Parex USA, Inc.
   2. Sto Corp.
   3. Or approved substitution.

C. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.02 SYSTEM DESCRIPTION

A. System to include the following components. All components are subject to the source limitations specified above.
   1. Air and Water Resistive Membrane Barrier.
   2. Accessory Materials.
   3. Adhesive - installed in vertical ribbons to facilitate egress of incidental moisture.
   4. Expanded Polystyrene (EPS) Insulation Board.
   5. Base Coat.
   6. Reinforcing Mesh.
   7. Finish Coat.
   8. Joint Sealants.

2.03 EIFS MATERIALS

A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive; with VOC content of 250 g/L or less.

B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water-resistive barriers; compatible with substrate and complying with physical and performance criteria of ASTM E2570/E2570M.
   1. Product to be the same or compatible with equivalent product installed behind other materials. See spec.

C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with one of the following:
   1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
   2. Factory-mixed non-cementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

E. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C578, Type I; and EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
   1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E84.

3. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm) thick or in other thickness indicated, but not more than 4 inches (102 mm) thick or less than the thickness allowed by ASTM C1397.
4. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
5. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.
6. Reveals: As indicated on drawings. Profile to be "V" shaped, and 3/4" wide.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098 and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.
2. Strip Reinforcing Mesh: Not less than as recommended by EIFS manufacturer.
3. Detail Reinforcing Mesh: Not less than as recommended by EIFS manufacturer.
4. Corner Reinforcing Mesh: Not less than as recommended by EIFS manufacturer.

G. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

H. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.

I. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

J. Finish-Coat Materials: EIFS manufacturer's complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
   a. Aggregate: Marble chips of size and color to match Architect's sample.
2. Colors: As specified herein and matching Architect's sample.
3. Textures: As specified herein and matching Architect's sample.

K. Water: Potable.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.
1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
6. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C1397.

M. Sealants: Provide Sealants as recommended by manufacturer. See Section 07 92 00.
1. An ultra low modulus, high-performance, one-part, moisture-curing silicone joint sealant with physical properties making it an ideal sealant for sealing dynamic joints.
a. Tremco Spectrem 1.
b. Dowsil 790.
c. Or approved equal.

2.04 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

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.
1. Refer to manufacturer's instructions for installation tolerances.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
1. Refer to SMACNA standards, EIFS manufacturer's details for requirements for flashing installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.03 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

B. Install high impact reinforcing mesh as specified at ground level, high traffic areas, play areas, sport areas and other areas exposed to impact damage as designated on contract documents.
1. Install to 6' height at typical ground level areas.
2. Install to 12' height where play or outdoor sport areas are adjacent.

3.04 SUBSTRATE PROTECTION APPLICATION

A. Primer/Sealer: Apply over substrates and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

B. Water-Resistive Coating: Apply over EIFS to provide a water-resistive barrier.
   1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.

3.05 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.
   1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
   2. Windowsill Flashing: Use at windows unless otherwise indicated.
   3. Expansion Joint: Use where indicated on Drawings.
   4. Casing Bead: Use at other locations.
   5. Parapet Cap Flashing: Use where indicated on Drawings.

3.06 INSULATION INSTALLATION

A. Board Insulation: Attach insulation to substrate in compliance with ASTM C1397 and the following:
   1. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
   2. Apply Insulation in vertical orientation to allow for drainage.
   3. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
   4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
   5. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
   6. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
   7. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
      a. Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
      b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
   8. Interlock ends at internal and external corners.
   9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
   10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
   11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.
   12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
   13. Install foam build-outs and attach to structure.
   14. Interrupt insulation for expansion joints where indicated.

15. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
16. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
17. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
18. Treat exposed edges of insulation as follows:
    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
19. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. At floor lines in multilevel wood-framed construction.
4. Where wall height or building shape changes.
5. Where EIFS manufacturer requires joints in long continuous elevations.

3.07 BASE-COAT INSTALLATION

A. Waterproof Adhesive/Base Coat: To exposed surfaces of insulation, apply in minimum thickness recommended in writing by EIFS manufacturer where indicated on Drawings.

B. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.

C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

E. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
1. Install high impact mesh at any first floor locations and wherever EIFS is adjacent to occupied areas.
2. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
3. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

F. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.08 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.09 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. As stipulated in Ch. 17 of the ICC (IBC).

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. EIFS Tests and Inspections: According to ASTM E2359.

D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 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 EIFS coatings.

3.11 EIFS SCHEDULE

A. Color and Texture:
   1. EIFS-X1:
      a. Color: Match Sherwin Williams "Neutral Ground" SW 7568.
      b. Texture: Freestyle Finish.
   2. EIFS-X2:
      a. Color: Match Sherwin Williams "Accessible Beige" SW 7036.
      b. Texture: Freestyle Finish.
   3. EIFS-5a:
      a. Color: Match color of aluminum storefront Dark Bronze.
      b. Texture: Smooth Metalic.
   4. EIFS-5b:
      a. Color: Match color of aluminum storefront Dark Bronze.
      b. Texture: Freestyle Finish.
   5. EIFS-6:
      a. Color: Match Sherwin Williams "Shiitake" SW 9173.
      b. Texture: Freestyle Finish.

END OF SECTION

SECTION 07 27 01
HIGH PERFORMANCE VAPOR RETARDER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance vapor retarder, including surface preparation.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures
B. Section 01 40 00 - Quality Requirements
C. Section 01 60 00 - Product Requirements
D. Section 05 40 00 - Cold Formed Metal Framing
E. Section 07 21 00 - Thermal Protection
F. Section 07 27 26 - Fluid Applied Membrane Air Barriers
G. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Membrane Roofing
H. Section 09 21 16 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

A. ISO 9972:2006 / EN 13829 - Determination of air permeability of buildings, Fan pressurization method.
B. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
C. ASTM E84 - Standard test method for surface burning characteristics of of building materials.
D. ASTM E2178 - Standard Test method for. Air Permeance of Building Materials.
E. AATCC 127 - Hydrostatic pressure test.
F. ISO 12572 - Hygrothermal performance of building materials and products.
G. EN 1849-2 - Flexible sheets for waterproofing - Determination of thickness and mass per unit area.
H. EN 12114 - Thermal performance of buildings - Air permeability of building components and building elements.
I. EN 12310-1 - Flexible sheets for waterproofing. Determination of resistance to tearing (nail shank)
J. EN 12311-2 - Flexible sheets for waterproofing. Determination of tensile properties.
K. EN 13859-1 - Flexible sheets for waterproofing - Underlays for discontinuous roofing (sheathing)
L. EN 1296 - Flexible sheets for waterproofing - Method for artificial ageing by long term exposure to elevated temperature.
M. EN 1931: Determination of water vapor transmission properties.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
C. Installation instructions and recommendations.
D. Storage and handling requirements and recommendations.
E. Procurement:
    1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
    2. Submit inventory to Owner within 5 days of delivery of materials.
    3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Performance target: required airtightness level for this project is 1.0 ACH50 air changes per hour (ACH50). Minimum acceptable air-tightness level is 1.0 ACH50 for buildings over 20,000 SF.

C. Installer Qualifications: Comply with one of the following requirements:
   1. The (sub-)contractor installing the interior airtight layer shall have as minimum experience with at least two buildings that was independently tested below 1.0ACH
   2. The (sub-)contractor has completed all manufacturer's training and is certified by manufacturer.

D. Mock-Up: Provide a mock-up for evaluation of installation techniques and application workmanship.
   1. Prior to installation of airtight layer, mock up airtight layer as follows to verify details and to demonstrate connections to adjoining construction elements, and other termination conditions.
   2. Install mockup of airtight layer in location designated by Architect.
   3. Do not proceed with remaining work until workmanship and application technique are approved by Architect.
   4. Construct typical interior wall, 8 feet wide by 8 feet long, illustrating materials interface and connections (tape, adhesives, gaskets), incorporating specified options including but not limited to the following:
      a. Junctions of walls, foundations, ceilings, floors and roof.
      b. Corner conditions.
      c. Window and doorframe connections.
      d. Insulation seals/battens.
      e. Cooperate and coordinate with the owner's inspection testing agency. Do not cover (with sheetrock, blocking, mechanical equipment or other elements that would restrict access to the airtight membrane) any components of the mock up (installed airtight layer membrane or other airtight elements) until it has been inspected, and approved.

E. Preconstruction Meeting:
   1. Convene a meeting with all subcontractors affected by the Work of this Section a minimum of one week prior to commencing work of this section.
   2. Coordinate Work with other subcontractors (plumbers, electricians, carpenters, HVAC), operations and installation of finish materials to install correct-sized gaskets on pipes, ducts and cable when these elements pass through the interior airtight layer, and to avoid damage to installed materials. Before they commence work on site, provide each effected trade with sufficient gaskets.
   3. After meeting, post the following warning in a prominent location at all building entrances and top of each stair - 1/2” letter height minimum for header, 1/4” for all other text
   4. Airtight Building:
      a. No drilling, airtight construction: no cutting, airtight membranes.
      b. Report all penetrations to supervisor.

1.06 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 materials on pallets in clean and dry areas, not exposed to direct sunlight and in accordance with manufacturer's instructions. Store adhesives and primers at temperatures at or above 40 degrees Fahrenheit (4 degrees Celsius) to facilitate handling.

C. Protect materials during handling and application to prevent damage, puncturing or contamination.

1.07 ENVIRONMENTAL CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) as per manufacturers recommendations. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Minimize exposure of airtight membranes to direct sunlight. Use blinds or covers over window openings to block direct sunlight to prevent UV damage to membranes, if membranes will not be covered by Gypsum board within 2 weeks or use exterior grade products.

C. Minimize exposure to water. If exposure is likely, expected or cannot be avoided, use exterior grade products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Pro Clima/Moll bauökologische Produkte GmbH, 68723 Schwetzingen Germany. Imported by 475 High Performance Building Supply, 334 Douglass street, Brooklyn NY.
   2. CertanTeed Corporation, 20 Moores Road, Malvern PA 19355

B. Or approved equal. Refer to section 01 60 00 Substitutions Requirements.

2.02 INTELLIGENT VAPOR RETARDER SYSTEMS

A. Intelligent vapor retarder.
   1. Description: Sheet applied vapor retarder that changes its permeability with changes to the ambient humidity.
   2. Less than one perm permeability when tested according to ASTM E96/E96M (dessicant method)
   3. Greater than 10 perms when tested according to ASTM E96/E96M (water method)
   4. Class A rated material per ASTM E84 (Flame spread: 0, SDI:35)
   5. Airtight material per ASTM E2178: 0.00005cfm/sf
   6. Appearance: Translucent white
   7. Weight 0.36 oz/sf ±15 g/m² (110g/m2)
   8. Thickness: 16 mils (0.4 mm ±0.1 mm) DIN EN 1849-2
   9. Perm rating: 13.20 to 0.13 (Sd value from 0.25m to >25m) ISO 12572
   10. Temperature exposure limits: -40 to 176 degrees F (-40 to 80C)
   11. Tensile Strength (DIN EN 13859-1)
      a. 350 N/50 mm MC
      b. 290 N/50 mm DC
   12. Elongation (DIN EN 13859)
      a. 15% (MC)
      b. 15% (DC)
   13. Nail Tear Resistance: 200N/200N (MC/DC) DIN EN 13859.
   14. Permeability consistent after artificial age testing: Pass – DIN EN 1296/1931.
   15. Products:
      a. ProClima/Intello Plus.
      b. CertainTeed/Membrain.
      c. Or approved Substitution.

B. Tapes and adhesives:
   1. As supplied by manufacturer and employed according to manufacturer's instructions.
      a. VOC free.
      b. Complies with standards of ASTM D3330.

2.03 ACCESSORIES

A. Application tools as recommended and supplied by manufacturer.

B. Primers as supplied by manufacturer:
   1. VOC free.

C. Pipe and penetration protection:
   1. Rubber or plastic gasket materials as supplied by manufacturer.
   2. Installed and taped according to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates/surfaces have been properly prepared and cleaned from dust, silicones, oils and grease. Before installation, verify substrate is free of splinters, nails or other objects that could puncture membranes.

B. If window or door opening preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

C. If there are unexpected pipes, ducts or wires in the installation area/airtight layer or these penetrations do not have manufacurer's gaskets around them, notify architect of unsatisfactory preparation before proceeding.

D. If floor, walls or ledger boards have been built that interfere with the airtight layer and a drawn/planned pre-installed airtight membrane was not installed as per sequencing plan, notify architect of unsatisfactory preparation before proceeding.

E. If long term exposure to UV or liquid water is likely or can be expected, use exterior grade products.

F. Acceptance of Conditions: Beginning of installation constitutes acceptance of existing conditions.

3.02 PREPARATION

A. Clean and prepare surfaces to receive air/vapor barrier in accordance with manufacturer's installation guidelines.

B. All surfaces must be clean, smooth and dry and must be clean of oil, dust, and silicone.

C. Batt installation: install membrane immediately after batt insulation is installed in winter.

D. Properly ventilate space or use dehumidifier to prevent high humidity conditions after concrete pours, Gypsum board compounding and tile work. Monitor humidity if needed to ensure it stays below 60% relative humidity.

3.03 APPLICATION

A. Apply airtight layer/vapor retarder in accordance with manufacturer's instructions.

B. Install membranes taut and without creases along the substrate.

C. Overlap subsequent courses of membrane. Use the printed lines on the membrane as a guide.

D. Mechanically fasten as per 475 installation manuals.

E. Battens for service cavities for densepacking should be spaced less than 20” o.c. and be perpendicular to the direction of the structure behind. Or other means should be employed to mechanically fix the membrane sufficiently to the substructure to long term support the weight/force exerted by the insulation - please contact 475 for additional means and methods.

F. Tape all overlaps. Use a pressurization tool to ensure there is sufficient back-pressure when applying the pressure sensitive tapes. Make sure that tape joints are not permanently under stress, ie are supported by a batten or by cross taping the taped joint with 12” long pieces of tape every 12”.

G. Overlap the membrane a minimum of 2” over dissimilar airtight materials (concrete, plaster).

H. Use manufacturer's recommended adhesives and primers to adhere membranes to concrete, brick, plaster or rough OSB. Leave some slack in the membrane to allow for expansion and contraction between these dissimilar materials.

I. If taping to membrane to porous or unknown substrates, they should be free of oil, silicone and dust. Do an adhesion test when in doubt. Primer recommended for application to brick, concrete, wood fiber insulation board and certain OSB brands.

J. Cut membrane with a utility knife in detail around penetrations.

K. Seal membranes to windows, joist and beams with manufacturer's recommended airtight window tapes. Follow application guides of specific tapes.

L. Seal all penetrations with gaskets taped with airtight tape to airtight layer. Air seal around pre-existing penetrations (pipes, ducts or cables) with manufacturer's recommended tape in step like fashion, avoiding creases in tape.

M. Apply blown in insulation directly after installing interior airtight membranes.

N. Inspect membrane before blower door test and/or dense-packing insulation. Ensure:
   1. Each overlap is taped and has been pressurized.
   2. Staples applied at appropriate intervals.
   3. Counter battens at recommended distances.
   4. Tears and punctures repaired with manufacturer's recommended tape.
   5. That the recommended time for adhesives and tapes to set has passed before testing.

3.04 TESTING

A. Life Time may elect to test the air tight layer after installation.

B. Document any leaks, and repair with manufacturer's recommended tapes, adhesives and accessories.

C. Repeat test until building complies with project airtightness (ACH50 or CFM/SF75) goal, but at a minimum better than 1.0ACH50 or 0.15CFM/SF75.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Repair tears, punctures or burns (e.g. from sweating copper pipe) and/or replace damaged products before covering materials.

C. To protect interior airtight layer/membranes, apply service cavity insulation and Gypsum board as soon as possible, and not later than specified exposure limit of used materials. Use tarps or other means of blocking UV if exposure times will be exceeded to protect membranes.

3.06 FINAL TEST

A. Life Time may test the installed membrane/interior airtight layer when:
   1. All penetrations have been made and sealed.
   2. Gypsum board and other finishes on exterior walls have been installed.

3.07 FIND AND REPAIR LEAKS

A. Repeat testing and repairs until the project complies with the project airtightness goal.

END OF SECTION

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SECTION 07 27 26
FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fluid-applied membrane air barrier, vapor retarding.
   2. Load-bearing fluid applied membrane air barrier.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures

B. Section 01 40 00 - Quality Requirements

C. Section 01 45 33 - Code-Required Special Inspections and Procedures

D. Section 01 60 00 - Product Requirements

E. Section 03 30 00 - Cast in Place Concrete

F. Section 03 45 00 - Precast Architectural Concrete

G. Section 04 20 00 - Unit Masonry

H. Section 07 08 00 - Commissioning of Thermal and Moisture Protection

I. Section 07 21 00 - Thermal Insulation

J. Section 07 24 19 - Water Drainage Exterior Insulation and Finish System

K. Section 07 42 00 - Metal Wall Panels

L. Section 07 92 00 - Joint Sealants

M. Section 09 21 16 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

A. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

B. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

E. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

F. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Include details of mock-ups.

C. Compatability Letters:
   1. Submit letters from the Manufacturer ensuring compatability with adjacent materials, including Waterproofing, EIFS, sealants, etc.

D. Procurement:

1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Applicator Qualifications: Company experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

C. Mockup: See drawings for requirements for Mockup.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls per manufacturer's written instructions.

D. Store materials at Project site in a cool, dry location, out of direct sunlight, protected from inclement weather and other sources of damage. Minimum storage temperature shall be 40 degrees F (4 degrees C).

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
   1. Do not apply wet materials during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
   2. At time of application, minimum air and wall surface temperatures shall be 40 degrees F (4 degrees C).and rising. Maintain these temperatures, with adequate air ventilation and circulation, for a minimum of 12 hours thereafter, or until products are dry.

PART 2 PRODUCTS

2.01 FLUID-APPLIED MEMBRANE AIR BARRIER

A. General: Provide products that are certified to be compatible by manufacturer of substrate.

B. Air and Water-Resistive Barrier Components:
   1. Acceptable Product: Subject to compliance with requirements, provide Backstop NTX by Dryvit.
      a. Alternative product: Tremco ExoAir 230.
   2. Barrier Membrane: Flexible, polymer-based, noncementitious, water-resistive coating.
      a. Finish Surface: Smooth.
   3. Grid Tape: Open weave fiberglass mesh tape with pressure sensitive adhesive in rolls 4 inch (102 mm) wide by 100 yards (91 m) long.

C. Load Bearing Fluid Applied Membrane Air Barrier:
   1. General: Load bearing membrane, for the application of adhered masonry or tile.
      a. Meet or exceed requirements ANSI A118.10, ANSI A118.12 for adhered masonry or tile.
      b. Meet or exceed requirements of ASTM E2357 for air barrier assemblies.
      c. Compatible with products specified for adhered tile and masonry assemblies, see Sections 04 20 00 and 09 30 00.
   2. Manufacturer and Product:
      a. Laticrete MVIS Air and Water Barrier.
      b. Or approved equal.

D. Flashing Materials: Used to protect substrate edges at terminations.
   1. Liquid Applied: Flexible water-based polymer material, ready for use.
      a. Acceptable Product: AquaFlash Liquid and AquaFlash Mesh by Dryvit or LiquiFiber by Carlisle.
   2. Sheet Type Flashing Tape and Surface Conditioner:
      a. Flashing Tape: High density polyethylene film backed with rubberized asphalt adhesive in rolls 4 inch (102 mm), 6 inch (152 mm), and 9 inch (229 mm) wide by 75 feet (23 m) long.
      b. Flashing Tape Surface Conditioner: Water-based surface conditioner and adhesion promoter for flashing tape.
      c. Acceptable Product: CCW-705 by Carlisle.

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Modified Bituminous Strip: Vapor-retarding, 40 mil (1.0 mm) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4 mil (0.1 mm) thick polyethylene film with release liner backing.

C. Butyl Strip: Vapor-retarding, 30 to 40 mil (0.76 to 1.0 mm) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.
   1. For use with vapor-permeable barrier.

D. Adhesive-Coated Transition Strip: Vapor-permeable, 17 mil (0.43 mm) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms (2145 ng/Pa x s x sq. m).

E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

F. Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00 – Joint Sealants.
   1. Acceptable Product: LM 800XL by Carlislefor joints and terminations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate per manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate per ASTM C1193 and air barrier manufacturer's written instructions.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant per ASTM C1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.04 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials per air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air-barrier.
   1. Coordinate installation of air-barrier with installation of roofing membrane and base flashing to ensure continuity of air-barrier with roofing membrane.
   2. Install butyl (transitions to roof membrane) strip on roofing membrane or base flashing so that a minimum of 3 inches (76 mm) of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air-barrier sheet in same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier membrane continuously to roofing membrane air-barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Seal top of through-wall flashings to air-barrier with an additional 6 inch (152 mm) wide strip as recommended by air-barrier manufacturer.

G. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (152 mm) beyond repaired areas in strip direction.

3.05 MEMBRANE INSTALLATION

A. Smooth Surface Finish: Apply smooth surface material per system manufacturer's published instructions.
   1. Mix materials with equipment and for duration recommended by system manufacturer.
   2. Prior to application of finish surface, apply strip of grid tape over sheathing joints, including inside and outside corners, and trowel apply layer of texture finish over grid tape. Spot cover fastener heads.

3. Apply finish to substrate using a trowel, roller, or spray equipment, depending on substrate, and backroll. Apply membrane to achieve uniform thickness over wall area. Measure thickness of membrane during installation to confirm minimum thickness is being met.
4. Apply smooth finish over entire wall surface, including previously treated joints and fasteners.
5. Allow material to dry a minimum of 4 hours prior to application of flashing liquid or tape, and adhesively applied EPS insulation board. Cool damp weather will require longer drying times. During cool damp weather, flashing tape surface conditioner may be necessary for proper flashing tape adhesion. Protect fluid applied waterproofing from exposure to precipitation and damage until membrane is fully cured.
6. Install specified Exterior Insulation and Finish System per published installation instructions for specific system being used.

3.06 CLEANING

A. Clean spills, stains, and soiling from construction that would be exposed in completed Work using cleaning agents and procedures recommended by manufacturer of affected construction.

B. Remove masking materials after installation.

3.07 PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.
   2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

END OF SECTION

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SECTION 07 42 00
METAL WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Factory-formed and assembled, composite metal wall panels.
   2. Metal Soffit Panels.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 04 20 00 - Unit Masonry.

E. Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

F. Section 07 54 24 - Thermoplastic Polyolefin (TPO) Roofing.

G. Section 07 62 00 - Sheet Metal Flashing and Trim.

H. Section 10 14 00 - Signage.

1.03 REFERENCE STANDARDS

A. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

B. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

D. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

F. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

G. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

J. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Structural Performance: Capable of withstanding the effects of gravity loads and the following loads and stresses, based on testing per ASTM E330/E330M.
   2. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category, Exposure Category, and Internal Pressure Coefficient indicated on Structural Drawings.
   3. Snow Load: Design snow load shall be based on snow load parameters found in the Structural Drawings.
   4. Dead Load, Live Load: As required by applicable building code.
   5. Thermal Movements: Provide assemblies that allow for thermal movements resulting from maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
      a. Temperature Change (range): 120 deg F (64 deg C), ambient; 180 deg F (100 deg C), material surfaces.

b. Sealed joints shall allow free and silent movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.
c. Manufacturing, installation and sealing shall prevent deformation of exposed surfaces.
d. Design panel system to accommodate substructure tolerance of +0 to -1/8 inch.
e. Not Permitted: Vibration harmonics; wind whistles; noises caused by thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system.

6. Joints: Dry Joint System

1.05 SUBMITTALS

A. Product Data: For each type of metal wall panel and accessory indicated.

B. Shop Drawings: Show layouts of metal wall panels, including plans, elevations, sections, details, and attachments to other Work.
1. For Metal Panels: include details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories.
2. Calculations: Signed and Stamped by Engineer liscensed in the State where the Project is located, certifying the assembly will withstand design loads. See Structural Drawings.

C. Coordination Drawings: Drawn to scale and coordinating metal wall panel installation with penetrations and wall-mounted items.

D. Samples for Verification: Of each type of metal finish required, prepared on samples of same thickness and material indicated for final work.

E. Quality Assurance Submittals: Submit the following:
1. Certificates: Product certificates signed by manufacturer certifying materials comply with the specified performance characteristics and criteria, and physical requirements.
2. Weld Strength Calculations shall be stamped and signed by a professional engineer specializing in the application of welding technology.
3. Installer Qualifications: Acceptable to manufacturer.

F. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

1.06 QUALITY ASSURANCE

A. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 2 years from date of Substantial Completion.
3. The contractor shall warrant the materials to be free of faults and defects in accordance with the General Conditions, except that the warranty shall be extended by paint manufacturer’s standard multi-year warranty. The warranty shall be in writing and shall be signed by the manufacturer.

B. Material Finish Warranty:
1. Failures include the following:
a. Cracking.
b. Fading or discoloration beyond normal weathering.
c. Chalking.

d. Flaking.

2. Warranty Period:
   a. Anodic Finish: 5 years from Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from 1 of the following manufacturers:
   1. Atas International Inc.
   2. Alpolic.
   3. Protean.
   4. Alucobond USA.
   5. Metal Sales Manufacturing Corporation.
   6. Or approved substitution.

2.02 MISCELLANEOUS METAL FRAMING

A. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
   1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Joint Splines:
   1. Aluminum/Metal Composite material to match panel, provided by panel Manufacturer.

C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, 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.

D. Welding Standards: As follows:
   1. Comply with AWS AWS D1.2/D1.2M, “Structural Welding Code – Aluminum.”
   2. Comply with AWS AWS D1.3/D1.3M , “Structural Welding Code – Sheet Steel.”

2.04 COMPOSITE METAL WALL PANELS

A. General: Provide factory formed and assembled metal wall panels fabricated from 2 metal facing sheets and core material laminated or otherwise securely bonded, without use of contact adhesives or pinch rollers, to facing sheets during fabrication.
   1. Face Sheets: Aluminum alloy 3105 H14, 0.020 inch (0.51 mm) thick and as follows:
      a. Class I, Color Anodic Finish: AA-M12C22A42/A44.
      b. Thermally bonded in a continuous process, under tension, to the core material.
   2. Core: Thermoplastic material that meets performance characteristics specified when fabricated into composite assembly.
   3. Bond Integrity: Tested for resistance to delamination as follows:
      a. Peel Strength (ASTM D1781): 22.5 in-lb/in (100 N-m/m) minimum.
      b. No degradation in bond performance after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
   4. Fire Performance:
      a. Flamespread (NFPA 285): Meets Requirements (in tested assembly).
      b. Flamespread (ASTM E84): 25 maximum (4 and 6 mm).
      c. Smoke Developed (ASTM E84): 450 maximum (4 and 6 mm).

d. Surface Flammability (Modified ASTM E108): Pass (4 and 6 mm).
e. V-O Rating (4 mm): Comply with UL 94.

5. Production Tolerances:
   a. Width: +/- 2 mm.
   b. Length: +/- 4 mm.
   c. Thickness (4 mm Panel): +/- 0.008 inch (0.2 mm).
   d. Thickness (6 mm Panel): +/- 0.012 inch (0.3 mm).
   e. Bow: Maximum 0.5% length or width.
   f. Squareness: Maximum 0.2 inch (5 mm).
   g. Edges of sheets shall be square and trimmed.
6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
7. Finish:
   a. Anodic Finish, see below.
8. Accessories:
   a. General: Provide fabricator’s standard accessories, including fasteners, clips, anchorage devices and attachments for specific applications indicated on contract documents.

2.05 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

B. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) thick, metallic-coated steel sheet. Provide flashing and trim 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 wall panels.

C. Butyl Tape: Type and size as recommended by panel manufacturer.

D. Clip Angles/Channels: 1/8 inch thick formed metal, compatible with plate panel skin.

E. Fasteners: As recommended by panel manufacturer.

F. Soffit Panels:
   1. Architectural Building Components; Flush Panel.
   2. ATAS International, Inc.; Wind-Lok Soffit Panel.
   3. Berridge Manufacturing Co.; FW-12 Panel.
   4. Carlisle Metals Company: CM FWI Panel.
   5. Approved substitution.

2.06 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at 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.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Composite Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10-psi (69-kPa) pressure. Use of contact adhesives with pinch-roll process is not acceptable.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA (ASMM) "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

E. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical finish: nonspecular as fabricated; 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 606.1 or AAMA 608.1.
   1. Color: Dark Bronze. Match Exterior Storefront Color.

PART 3 EXECUTION

3.01 PREPARATION

A. Install flashings and other sheet metal to comply with requirements specified in Section 07 62 00.

B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage per ASTM C754 and metal wall panel manufacturer's written recommendations.

3.02 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal wall panels by torch is not permitted.
   2. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   3. Install screw fasteners in predrilled holes.
   4. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   6. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners: Use aluminum or stainless-steel fasteners for surfaces exposed to exterior and aluminum or galvanized steel fasteners for surfaces exposed to interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.
   1. Coat back side of aluminum wall panels with bituminous coating where wall panels will contact wood, ferrous metal, or cementitious construction.

3.03 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. Clean exposed surfaces of sun control devices that are not protected by temporary covering to remove fingerprints and soil during construction period.

D. Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

E. Clean and touch up minor abrasions in finished with air-dried coating that matches color and gloss, and is compatible with, factory–applied finish coating.

END OF SECTION

SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Vapor barrier.
   2. Roof insulation.
   3. Substrate for roofing.
   4. Mechanically fastened thermoplastic polyolefin (TPO) roofing system.
   5. Flexible flashings.
   6. Accessory sealants.
   7. Roof walkway system.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast in Place Concrete.

E. Section 05 31 00 - Steel Decking.

F. Section 06 10 00 - Rough Carpentry.

G. Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

H. Section 07 21 00 - Thermal Insulation.

I. Section 07 62 00 - Sheet Metal Flashing and Trim.

J. Section 07 72 33 - Roof Hatches.

K. Section 07 92 00 - Joint Sealants.

1.03 REFERENCES

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

D. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.

E. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

F. FM 4450 - Class 1 Insulated Steel Deck Roofs; Current Edition.

G. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.

H. FM 1-28 - Design Wind Loads; Factory Mutual System; 2007.

I. FM 1-29 - Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2006.

J. ICC (IECC)-2021 International Energy Conservation Code, 2021 or most recent adopted edition.

K. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2007. (ANSI/SPRI ES-1).

1.04 SYSTEM DESCRIPTION

A. Design: Drawings are based on generic, single ply membrane roofing system.
   1. System to be fully adhered upon a composite roof deck.
   2. System to be mechanically fastened upon a steel roof deck.
   3. Selected roofing system manufacturer and installer shall provide all necessary details to ensure roofing system meets specified regulatory and performance requirements, over building structure indicated.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Meeting Submittals:
   1. Pre-installation meeting minutes.

D. Materials and Equipment Submittals:
   1. Shop Drawings:
      a. Prepared by roofing membrane manufacturer, indicating roof configuration, sheet layout, perimeter details and all joint details or termination conditions and conditions of interface with other materials. Assign Shop Drawings a project number or name referencing this specific project.
      b. Pre-Warranty Submittal: Submit "Sample" warranty from membrane manufacturer. Sample warranty shall include manufacturer's warranty number, duration of warranty, name of project, address of project, and shall identify the roofing contractor and describe the roofing materials and assembly to be installed by this roofing contractor.
   2. Product Data and Installation Instructions: Indicating sheet membrane, elastic flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of membrane.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Quality Control Submittals: Submit the following:
   1. Certification: Indicating that applicator has been factory trained and approved by membrane manufacturer to install roofing membrane.
   2. Certification: Indicating compliance with specified regulatory requirements.
      a. Submit test reports, listing cards, or other documentation showing compliance.
   3. Inspection Report: Indicating approval by membrane manufacturer's inspector.

G. Closeout Submittals:
   1. Warranty: As specified in this Section.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer Qualifications: Qualified manufacturer that is approved by FM Approvals for membrane roofing system identical to that used for this Project.

C. Installer Qualifications: Qualified firm, with a minimum of 5 years experience specializing in the installation of specified roofing system, which is approved, authorized, or licensed by membrane

roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. Installer shall be experienced in seam probe and patch activity. Include in Bid Costs to execute a complete probe of welds on roofing system and to make repairs to seam defects.
2. Maintain full-time field superintendent or foreman, with minimum of 5 years experience in all phases of installation with specified roofing system, at Project site during roofing installation.

D. Source Limitations: Obtain components, including roof insulation and fasteners, if any, for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

E. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by qualified testing agency. Identify materials with appropriate markings of applicable testing agency.

F. Pre-Installation Meeting: Convene pre-installation meeting a minimum of 1 week prior to commencing Work of this Section.
   1. Require attendance of LTF Construction Project Manager or Superintendent, Roofing System Applicator, Technical Representative employed by Roofing System Manufacturer and other parties directly affecting Work of this Section.
   2. Meeting Notes: Roofing Contractor shall maintain minutes of meeting and shall distribute within 3 working days of the meeting to the following LTF Construction.
   3. Pre-Installation Meeting Agenda:
      a. Review of drawings and specifications for application of roofing system.
      b. Review of applicable local code requirements for roofing system.
      c. Review proposed application procedures and coordination required with other trades.
      d. Presentation of a booklet of the standard technical details from the manufacturer's Technical Manual that shall be utilized for the installation.
      e. Deviations from the Technical Manual, (i.e. approved project details, either from project Drawings or proposed by roofing contractor), that have also been approved by LTF Construction.
      f. Review of permitting process and local code requirements, where applicable.
      g. Review of Project Conditions:
         1) Tentative timetable of execution.
         2) Work Crew: expectations for the execution of the project within the timetable.
         3) Roofing contractor's superintendent: Identify individual who shall be present during the duration of the installation.
         4) Emergency Contact and 24 hour Response Number.
         5) Review of Forecasted Weather Conditions:
            (a) Roofing contractor's practice for securing and storage of product on the roof which shall prevent damage or loss of product during high winds or precipitation.
      h. Review the following with the roofing contractor:
         1) Commitment to a timely execution.
         2) Summary statement of roof quality control practices:
            (a) Routine seam sampling.
            (b) Complete and systematic probe and patch of all seam defects.
         3) Roofing contractor to identify rooftop conditions and locations where other trades are notified against abuse of roof membrane from:
            (a) Contaminants.
            (b) Smoking.
            (c) Construction debris.
         4) Review proposed changes and deviations from drawings and specifications.
      i. Review of shop drawings for perimeter edge, tie in of lower roofs to vertical walls (where specified) and other required submittals.
      j. Review required inspections, contractor licensing by manufacturer, contractor history managing and executing projects of this size, and quality expectations for this application.

k. Review definition of what is an “approved deck” which shall be covered with roofing system.
l. Review perimeter wall cap elevations and lumber attachment as a suitable substrate for receiving the waterproofing perimeter flashings.
m. Review submission of Pre-Warranty Submittal as specified herein.
1) Pre-Application Inspection:
(a) Walk-through of area to receive roofing application.
(b) Agreement on condition of decking and walls as acceptable for receiving new roofing system.

1.07 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 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 permanent deflection of deck.

E. Roofing Contractor shall store roofing materials according to Manufacturer’s Requirements.

1.08 FIELD CONDITIONS

A. Ambient Conditions: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed per manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A. Special Warranty: Manufacturer's Total System Warranty, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roofing accessories, and other components of a complete membrane roofing system.
a. Include warranted wind speed rating with documentation.
2. Warranty Period: 20 years from date of Substantial Completion.
3. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
4. Pro-rated system warranties will not be accepted.
5. As a special consideration for Owner – Manufacturer shall provide an inspection at 24 months post warranty start date. Inspection request shall be initiated by Owner.

B. Include evidence of manufacturer's warranty reserve as part of Project submittals for Architect's approval.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing 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. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by qualified testing and inspecting agency to resist uplift pressure calculated per ASCE 7.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with the following requirements:
   1. FM 4450 and FM 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable.
   2. ANSI/SPRI/FM 4435/ES-1 as part of edge performance for membrane roofing system in resistance to wind uplift.
   3. Fire/Windstorm Classification: Class 1A-90.
   4. Identify materials with FM Approvals markings.

E. Warranty: Insulation supplied by membrane manufacturer to be included with roof warranty.

2.02 TPO MEMBRANE ROOFING

A. Mechanically Fastened Thermoplastic Polyolefin Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, uniform, flexible TPO sheet.
   1. Basis of design: Amrize Building Envelope: Elevate UltraPly TPO, InvisiWeld System.
   2. Mechanically attached via induction welding process at steel deck roofs. See Drawings.
   3. Thickness: 60 mils (1.5 mm), nominal.
   4. Color:
      a. TPO-2: Exposed Face Color : Tan.
   5. Other Acceptable Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Flex Roofing Systems.
      c. GAF Materials Corporation.
      d. Johns Manville.
      e. Mule-Hide Products Co., Inc.
      f. Versico Incorporated.

2.03 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Membrane Adhesive: Manufacturer’s recommended spray adhesive.
   1. Elevate Building Products: Jet Bond Spray Adhesive
   2. Or approved Equal.

C. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.

D. Bonding Adhesive: Manufacturer's standard.

E. Slip Sheet: Manufacturer's standard, of thickness required for application, when required by roof system manufacturer.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 inch by 1/8 inch (25 by 3 mm) thick; with anchors.

G. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer and designer of substrate.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, cover boards, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.04 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Roof Insulation: Where indicated, provide the following types of insulation:
   1. Main Roof Field: Polyisocyanurate board insulation, ASTM C1289, felt or glass-fiber mat facer on both major surfaces. Insulation shall be provided in two layers, maximum board thickness of 2.6” inches.
      a. Manufacturer and product: Ox Engineered Products: Ox ISO Red Max Polyisocyanurate.
         1) Or approved equal.
      b. Edges: Square.
      c. Type II, Class I, Grade 2.
      d. Total System R Value: 30 min.
   2. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.05 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
   1. Cover Board: High density Insulating cover board by Manufacturer.
   2. Insulation fasteners: Specially engineered and manufactured for the induction welding process. Type and size by roofing manufacturer.

B. Applied Insulation Adhesive: Insulation manufacturer's recommended low-rise, 2-component polyurethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
   1. Elevate Building Product: ISO Twin Pack Adhesive.
   2. Or approved equal.

2.06 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

2.07 VAPOR BARRIER

A. Provide a Class I vapor barrier as recognized by the International Building Code. Prepare substrate and install per manufacturer’s published specification.
   1. Provide vapor barrier equivalent to Elevate: V-Force Vapor BarrierMembrane.

PART 3 EXECUTION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

J. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

K. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent material seepage into building.

3.04 VAPOR BARRIER INSTALLATION

A. All deck/deck cover substrates (except metal decks) must be primed prior to application. Use only primer supplied by membrane manufacturer.

B. Application can be made at ambient temperatures as low as 25 °F (-4 °C) as long as membrane has been stored in a heated area so that it will be between 50 °F (10 °C) and 100 °F (38 °C) at the time of application.

C. Install insulation in a manner that will not compromise the vapor retarder integrity.

D. Install with minimum 3" (76.2 mm) side laps and 6" (152.4 mm) end laps.

E. Roll in with a 75 lb (34 kg) roller to fully mate each roll to substrate, including all lap areas.

3.05 INSULATION INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

E. Mechanical Fastening: Using specified fasteners and TPO coated insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.

F. Stagger insulation joints at each layer and between panels.
   1. Follow Manufacturers instructions for panel overlap.

3.06 SINGLE-PLY MEMBRANE INSTALLATION

A. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane mechanically attached to the substrate using fasteners and edge securement as specified and as required by membrane manufacturers.

E. Induction welding equipment shall be provided by others but approved for use by Manufacturer. All roofing contractors intending to use the equipment shall have successfully completed a training course provided by Manufacturer prior to installation.
   1. Induction welding tool calibration: As per the tool manufacturer’s printed guidelines, perform a tool calibration with induction welding tool, making test samples in the field with the TPO membrane and InvisiWeld plate. Before welding the membrane to the plates, calibrate the energy setting of the induction device following manufacturer’s instructions. Perform a peel test, at different energy settings and set the device at the lowest energy setting that creates a 100% bond.

F. All membrane to be welded shall be clean and dry.

G. Induction welding of the membrane: Follow induction tool manufacturer’s printed guidelines. Activate the weld between the TPO membrane and InvisiWeld plate using the electromagnetic induction device as supplied by others. The induction coil, demarked by a red circle on the device, shall be positioned over the center of the InvisiWeld plate, ± 1 inch (25 mm). Cycle time will be affected by available power, use a heavy gauge power cord, at a minimum 12 gauge by 100 feet.

H. When the induction welding cycle is complete, immediately place a weighted magnetic cooling clamp over the welded TPO membrane & plate assembly. This will ensure that there is adequate clamping of the membrane to the plate during cooling, ensuring a good weld. The magnetic cooling clamp device shall be left in place for a period of 60 seconds, at minimum, while the weld cools and sets.

I. Repeat steps G and H for every plate in assembly.

J. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in:12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, HD plates, or metal edging as indicated or as recommended by roofing manufacturer. Do not use InvisiWeld plates for edge securement.
   1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.

2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.07 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under the membrane anchorage leg.
   4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
   5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
   6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
   7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
   3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
   4. Provide termination directly to the vertical substrate as shown on roof drawings.

F. Roof Drains:
   1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
   2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
   3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
   4. Apply sealant on top of drain bowl where clamping ring seats below the membrane.
   5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
   1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
   2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
   3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.

4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.08 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch (25 mm) and maximum of 3.0 inches (75 mm) from each other to allow for drainage.
   1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
   2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.09 FIELD QUALITY CONTROL

A. Roof shall be inspected by inspector under the direct employment of the membrane manufacturer.

B. Seam Inspection:
   1. Roof shall be inspected upon completion, or more often as requested by LTF Construction, by inspector under the direct employment of the roof membrane manufacturer.

C. Daily inspections re required to be performed by the roofing applicator.
   1. Inspect welded seams after cooling or curing for continuity and integrity, using rounded, blunt end tool suitable for testing membrane which shall not damage roofing.
   2. Re-inspect and fully probe completed seams at end of each workday.

3.10 PROTECTION

A. Upon completion of roofing system installation, institute appropriate procedures for protection of completed roofing during remainder of construction period until Project is turned over to the Owner.

B. Make every effort to keep workers off completed roof. Obtain prior approval from Roofing Manufacturer and LTF Construction Project Manager and provide all required membrane protection should it be necessary for workers to access and work on completed roofing membrane.

C. Remove sharp construction debris materials such as loose fasteners and plates, metal strapping, metal clips, sheet metal trimmings, conduit and pipe scrap, nails, etc. immediately and place in protective containers. Remove waste material, packaging material, and construction debris from the roof surface on a daily basis.

D. Partial and Final Inspections:
   1. Inspection: Inspection by Manufacturer: Provide and 50-percent completion and final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
   2. Perform all corrections necessary for issuance of warranty.
   3. Submit confirmation of completed punchlist to LTF Construction Project Manager.

E. Repairs: Repair and replace, as required deteriorated or defective roofing found at final inspection.

F. Warranty: Warranty period shall commence with date of completion as defined in warranty of manufacturer.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Prefinished cap flashings.
   2. Counter-flashing over roof membrane base flashings.
   3. Roof joint cover flashings.
   4. Counter flashing at roof mounted mechanical equipment and vent stacks.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 04 20 00 - Unit Masonry Assemblies.

E. Section 06 10 00 - Rough Carpentry.

F. Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

G. Section 07 42 00 - Metal Wall Panels.

H. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.

I. Section 07 72 33 - Roof Hatches.

J. Section 07 92 00 - Joint Sealants.

K. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

L. Section 08 44 13 - Glazed Aluminum Storefront.

M. Section 23 74 13 - Packaged, Outdoor, Air-Handling Units.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

F. ASTM D962 - Standard Specification for Aluminum Powder and Paste Pigments for Paints; Current ed..

G. FM 1-49 - FM Global Loss Prevention Data Sheet; Current ed..

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SYSTEM DESCRIPTION

A. Work of this Section is to physically protect related work from damage that would permit water leakage to building interior.

B. Roof perimeter flashing installations to meet requirements of FM 1-49.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. General workmanship to comply with recommendations of Revere's "Copper and Common Sense" standards for detail and SMACNA (ASMM) architectural sheet metal manual.

C. Applicator: Company specializing in sheet metal flashing work with three years minimum experience.

1.06 SUBMITTALS

A. Material and Equipment Submittals:
   1. Shop Drawings: Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.
   2. Samples: Submit 6" x 6" samples of prefinished sheet metal for color approval.

B. Certifications, test reports, and calculations showing that all roofing edge metal meet the requirements of ANSI/SPRI/FM 4435/ES-1.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Closeout Submittals:
   1. Warranty.

1.07 STORAGE AND HANDLING

A. Store products under provisions of Section 01 60 00 - Product Requirements.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

D. Discard and replace materials that are damaged during storage or installation.

1.08 WARRANTY

A. Watertightness Warranty: Provide five (5) year warranty signed by Contractor and installer for water tightness.

B. Finish Warranty: Provide manufacturer's standard 20 year warranty covering color fade, chalking and film integrity; agreeing to replace, without additional cost, flashing which fails in materials or workmanship.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. 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.

C. 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.

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Drawings.

E. 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.

2.02 SHEET MATERIALS

A. Cap Flashings: Pre-coated galvanized steel; ASTM A653/A653M, G90; 24 gage minimum core steel, shop pre-coated with fluoropolymer coating.
   1. Firestone, Una-Clad.
   2. Peterson Aluminum Corporation, Pac-Clad.
   3. AlumaKlad/ColorKlad.
   4. Or Approved Substitution.

B. Non-Coated Galvanized Steel: ASTM A653/A653M, G90; 24 gage core steel.

C. Stainless Steel base flashing and drip edges: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) (0.40 mm) thick; smooth No. 4 - Brushed finish.

D. Colors: T.B.D. - as selected and verified by Architect from the full line of available colors.

2.03 GAUGES OF SHEET METAL

A. As indicated on Drawings. Where not indicated, use galvanized steel of minimum gauges as follows:
   1. Fascias, coping, and roof 24 gauge flashing with an exposed vertical face of 8" or less.
   2. Fascias, coping, and roof 22 gauge flashing with an exposed vertical face of 8" to 10".
   3. Fascias, coping, and roof 20 gauge flashing with an exposed vertical face of 10" to 15".
   4. Hook strips and keepers: 22 gauge (Minimum one gauge heavier that the flashing is securing).
   5. Other sheet metal work: 24 gauge.

B. Provide thicker gauge of sheet metal where required to meet ANSI/SPRI/FM 4435/ES-1.

2.04 ACCESSORIES

A. Fastener: Galvanized steel or stainless steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

B. Underlayment: ASTM D226/D226M; No.15 asphalt saturated roofing felt.

C. Protective Backing Paint: Bituminous.

D. Slip Sheet: Rosin sized building paper.

E. Sealant: SLNT-1, as specified in Section 07 92 00 - Joint Sealers.

F. Bedding Compound: Type compatible with materials with which it will come in contact.

G. Plastic Cement: Type compatible with materials with which it will come in contact.

H. Ice and Water Protection: Sheet membrane of rubberized asphalt bonded to sheet polyethylene with strippable release paper protecting rubberized asphalt side of membrane; 40 mil total membrane thickness; 36" wide. To be installed in all roof valleys and as starter strip 42” from bottom edge of roof. Unless other stated in manufactures recommended installation guidelines.
   1. GCP Vycor v40.
   2. Carlisle, WIP 300 HT.
   3. Or approved substitution.

I. Aluminum Foil Separation Tape: Where sheet membrane flashing comes in contact with incompatible material. See details, manufacturer's recommendations.
   1. 3M Venture Tape; Building Facing Tape.
   2. Or approved substitution.

2.05 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.

C. Form pieces in longest practical lengths; minimum 12 feet.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners. Use release tape, un-cored membrane and metal cover plate for seam construction.

1. Base flashing and drip edges adjacent to exterior walking, seating or play areas shall have preformed corners without exposed sharp edges.

E. Form material with cover plate seam. Use release tape, un-cored membrane and metal cover plate for seam construction.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant. Use release tape, un-cored membrane and metal cover plate for seam construction.

G. Fabricate vertical faces with bottom edge formed outward 1/4" and hemmed to form drip.

H. Form sheet metal pans 6 inch nominal square size, seal all seams in flashing watertight. Use Roof Membrane coated metal if required by roof system manufacture with 3 inch upstand, and 4 inch flanges. Fill pans watertight with pourable sealer.

2.06 FINISH

A. Typical Surfaces:
1. Shop prepare and prime exposed ferrous metal surfaces.
2. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
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 roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
4. Verify membrane termination and base flashings are in place, sealed, and secure.
5. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

D. Insert flashings into reglets to form tight fit. Secure in place with lead or plastic wedges at maximum 24 inches on center. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect.

F. Seam and seal all joints. Use release tape, un-cored membrane and metal cover plate for seam construction.

G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Seal metal joints watertight. Use release tape, un-cored membrane and metal cover plate for seam construction.

3.03 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches

staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

B. Apply slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.

3.04 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. 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.
   3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   5. Torch cutting of sheet metal flashing and trim is not permitted.
   6. Do not use graphite pencils to mark metal surfaces.
   7. Conform to drawing details included in SMACNA Architectural Sheet Metal manual and the 8th edition of Copper and Common Sense (by Revere).

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 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.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

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. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not solder metallic-coated steel sheet.
   2. Do not pre-tin zinc-tin alloy-coated stainless steel.
   3. Do not use torches for soldering.

4. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
5. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in zinc where necessary for strength.

3.05 ROOF-DRAINAGE SYSTEM INSTALLATION

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. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below gutter discharge.

C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.06 ROOF FLASHING INSTALLATION

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. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings: Anchor to resist uplift and outward forces according to 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 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant, anchor and washer at 36-inch 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 elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.07 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to 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. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 20 00 "Unit Masonry."

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.08 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.09 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.10 CLEANING AND PROTECTION

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.

D. 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.

E. 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.

END OF SECTION

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SECTION 07 72 33
ROOF HATCHES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Prefabricated roof hatches with integral support curbs, operable hardware, and counter-flashing.
   2. Roof hatch railing system.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements.

E. Section 06 10 00 - Rough Carpentry.

F. Section 07 54 23 - Thermoplastic Polyolefin Roofing.

G. Section 07 62 00 - Sheet Metal Flashing and Trim.

H. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; Current Edition.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

J. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016 (Reapproved 2023).

K. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

L. ASTM F2329/F2329M - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners; Current edition.

M. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.05 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other Work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled Work.

C. Pre-Warranty Submittal: Submit "Sample" warranty from membrane manufacturer. Sample warranty shall include manufacturer's warranty number, duration of warranty, name of project, address of project, and shall identify the roofing contractor and describe the materials and assembly to be installed by this contractor.

D. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

E. Operations and Maintenance: Submit Operation and Maintenance information as specified in 01 77 00 Closeout Procedures.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Performance Requirements:
1. General Performance: 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.

2.02 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.
1. 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).

B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Mill Finish: As manufactured.
2. Concealed Finish: Pretreat with 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 mil (0.013 mm).

C. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

2.03 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. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

C. Underlayment:
1. Polyethylene Sheet: 6 mil (0.15 mm) thick polyethylene sheet complying with ASTM D4397.

D. 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 nonremovable 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 per ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

E. 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.

F. Elastomeric Sealant: ASTM C920, elastomeric 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.

G. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

H. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.04 ROOF HATCH

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, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
1. Acceptable Products: Subject to compliance with requirements, provide 1 of the following specified products:
a. Babcock-Davis: BRHU.
b. Bilco Company (The): Type L Roof Hatch.
c. Milcor Inc.: Model No. RCS-3.

B. Type and Size:
1. Main Roof: Single-leaf lid, 30 by 96 inches (762 by 2438 mm)

C. Loads: Minimum 40 pound-force per square foot (1.9 kPa) external live load and 20 pound-force per square foot (0.95 kPa) internal uplift load.

D. Curb Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) (14 gage) thick.
1. Finish: Mill phosphatized.

E. Cover and Liner: 0.090 inch (2.3 mm) (11 gage) thick aluminum cover with 1 inch (25 mm) thick rigid fiberboard insulation and 0.040 inch (1.02 mm) (18 gage) thick aluminum cover liner.
1. Finish: Mill.

F. Construction:
1. Insulation: Manufacturer's rigid board.
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 inches (305 mm) unless otherwise indicated.

G. Hardware: Galvanized Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
1. Provide 2-point latch on lids larger than 84 inches (2134 mm).

2.05 ROOF HATCH RAIL SYSTEM

A. Furnish and install hatch rail system at all roof hatches shown on plans. The hatch rail system shall be field assembled and installed per the manufacturer’s instructions.

B. Performance characteristics:
1. High visibility safety yellow color shall be molded in.
2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.

3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
4. UV and corrosion resistant construction with a twenty-five year warranty.
5. Self-closing gate shall be provided with hatch rail system.
6. Posts and Rails: Shall be round pultruded reinforced fire retardant yellow fiberglass treated with a UV inhibitor.

C. Hardware: Mounting brackets shall be ¼" thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.

2.06 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM AMP 500-06 "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 range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install roof accessories per manufacturer's written instructions.
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. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. 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 coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: 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.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:
1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.

D. Seal joints with sealant as required by roof accessory manufacturer.

3.02 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing per ASTM A780/A780M.

B. Clean exposed surfaces per 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.

END OF SECTION

SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sprayed fire-resistive materials (SFRM).
   2. Thermal Barrier for installation at closed-cell spray foam insulation not directly covered by gypsum board.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 45 33 - Code-Required Special Inspections and Procedures.

D. Section 01 60 00 - Product Requirements.

E. Section 05 12 00 - Structural Steel Framing

F. Section 05 21 00 - Steel Joist Framing

G. Section 05 31 00 - Steel Decking

H. Section 05 40 00 - Cold-Formed Metal Framing

I. Section 07 21 00 - Thermal Insulation.

J. Section 07 81 60 - Intumescent Fireproofing.

K. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

B. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation; Current Edition, Including All Revisions.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

F. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).

G. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

H. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

I. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

J. ASTM E761/E761M - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

K. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.

L. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. ICC-ES AC23 - Sprayed Fire-resistant Materials (SFRMs), Intumescent Fire-resistant Coatings and Mastic Fire-resistant Coatings Used to Protect Structural Steel Members; Current Edition, Including All Revisions.

P. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meetings: Conduct meeting at Project site to comply with requirements in Section 01 31 00 – Project Management and Coordination.
   1. Review methods and procedures related to SFRM.
   2. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of fireproofing.
   1. Provide fire-rated assembly ratings to UL Design Nos. as shown on Drawings.

C. Evaluation Reports: For fireproofing, from ICC-ES AC23.

D. Preconstruction Test Reports: For fireproofing.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Field quality-control reports.

G. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products per specified requirements.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage qualified testing agency to perform preconstruction testing on field mock-ups of fireproofing.
   1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
   1. Bond Strength: Test for cohesive and adhesive strength per ASTM E736/E736M. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   2. Density: Test for density per ASTM E605/E605M. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
   3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying Work.
   5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including use of specially formulated bonding agents or primers.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 degrees F (7 degrees C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges per manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, per requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested per ASTM E119 or UL 263 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.

E. Asbestos: Provide products containing no detectable asbestos.

2.02 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

B. Low Density, Concealed/Commercial SFRMs:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.: Pyrolite 15 High Yield.
      b. Grace, W. R. & Co. - Conn.; Grace Construction Products: Monokote MK-6 Series.
      c. Isolatek International: Cafco Blaze-Shield II, Cafco 300.
      d. Southwest Fireproofing Products Co.: Type 5GP. Southwest is a Carboline Co.
      e. Or approved equal.
   2. Physical Properties:
      a. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) (20.59-kPa) (47.88-kPa), cohesive and adhesive strength based on field testing according to ASTM E 736.
      b. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, per ASTM E605/E605M.

c. Thickness: As required for fire-resistance design indicated, measured per requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than 0.375 inch (9 mm).
d. Combustion Characteristics: When tested in accordance with ASTM E136 shall be noncombustible.
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. Compressive Strength: When tested in accordance with ASTM E761/E761M, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf.
g. Corrosion Resistance: No evidence of corrosion per ASTM E937/E937M.
h. Deflection: No cracking, spalling, or delamination per ASTM E759/E759M.
i. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM ASTM E760/E760M.
j. Air Erosion: Maximum weight loss of 0.025 grams per square foot (0.270 g/sq. m) in 24 hours per ASTM E859/E859M.
k. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21 or rating of 10 per ASTM D3274 when tested per ASTM D3273.

C. Medium Density SFRMs.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Isolatek International: Cafco 400.
   b. Grace, W. R. & Co. - Conn.; Grace Construction Products: MonoKote Z-106/G.
   c. Southwest Fireproofing Products Co.: Type 7GP.
   d. Or approved equal.
2. Physical Properties:
   a. Bond Strength: Minimum 430-lbf/sq. ft. (7.18-kPa) (20.59-kPa) (47.88-kPa), cohesive and adhesive strength based on field testing according to ASTM E 736.
   b. Density: Not less than 22 lb/cu. ft. and as specified in the approved fire-resistance design, per ASTM E605/E605M.
   c. Thickness: As required for fire-resistance design indicated, measured per requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than 0.375 inch (9 mm).
   d. Combustion Characteristics: ASTM E136.
   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. Compressive Strength: When tested in accordance with ASTM E761/E761M, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf.
   g. Corrosion Resistance: No evidence of corrosion per ASTM E937/E937M.
   h. Deflection: No cracking, spalling, or delamination per ASTM E759/E759M.
   i. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E760/E760M.
   j. Air Erosion: Maximum weight loss of 0.025 grams per square foot (0.270 g/sq. m) in 24 hours per ASTM E859/E859M.
   k. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21 or rating of 10 per ASTM D3274 when tested per ASTM D3273.

D. Medium Density, Moisture Resistant SFRMs.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Isolatek International: Blaze-Shield HP.
   b. Grace, W. R. & Co. - Conn.; Grace Construction Products: MonoKote Z-106HY.

c. Southwest Fireproofing Products Co.: Type 7HD.
d. Or approved equal.

2. Physical Properties:
   a. Bond Strength: Minimum 430-lbf/sq. ft. (7.18-kPa) (20.59-kPa) (47.88-kPa), cohesive and adhesive strength based on field testing according to ASTM E736/E736M.
   b. Density: Not less than 22 lb/cu. ft. and as specified in the approved fire-resistance design, per ASTM E605/E605M.
   c. Thickness: As required for fire-resistance design indicated, measured per requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than 0.375 inch (9 mm).
   d. Combustion Characteristics: ASTM E136.
   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. Compressive Strength: When tested in accordance with ASTM E761/E761M, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf.
   g. Corrosion Resistance: No evidence of corrosion per ASTM E937/E937M.
   h. Deflection: No cracking, spalling, or delamination per ASTM E759/E759M.
   i. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E760/E760M.
   j. Air Erosion: Maximum weight loss of 0.025 grams per square foot (0.270 g/sq. m) in 24 hours per ASTM E859/E859M.
   k. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21 or rating of 10 per ASTM D3274 when tested per ASTM D3273.

2.03 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of Work and per each fire-resistance design. Verify compliance with the following:
   1. 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 fireproofing with substrates under conditions of normal use or fire exposure.
   2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that roof construction, installation of roof-top HVAC equipment, and other related Work is complete before beginning fireproofing Work.

C. Conduct tests per fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Cover other Work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

3.03 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, and other materials and procedures affecting fireproofing Work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and per fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following spraying operation in each area, complete coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in single course unless otherwise recommended in writing by fireproofing manufacturer.

I. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mock-ups.

J. Cure fireproofing per fireproofing manufacturer's written recommendations.

K. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

L. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish per manufacturer's written instructions for each finish selected.
   2. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the ICC (IBC), 1704.10.

B. Perform tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.05 CLEANING, PROTECTING, AND REPAIRING

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.

B. Protect fireproofing, per advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to Work of other trades.

D. Repair fireproofing damaged by other Work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.02 SYSTEM DESCRIPTION

A. Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. The following list includes some possible locations and applications, but is not all inclusive:
   1. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
   2. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
   3. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
   4. Gaps at the intersection of floor slabs and any exterior wall that is continuous between floors.
   5. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
   6. Openings between curtain walls and structural floor slabs.
   7. Construction joints in floors and fire rated walls and partitions.
   8. At expansion joints in walls, floors and wall and floor slab assemblies.
   9. Other existing penetrations at demising walls and other locations where required to maintain fire resistance rating of the construction.

1.03 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 45 33 - Code-Required Special Inspections and Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 30 00 - Cast in Place Concrete.

F. Section 04 20 00 - Unit Masonry.

G. Section 05 31 00 - Metal Decking.

H. Section 09 21 16 - Gypsum Board Assemblies.

I. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

D. FM (AG) - FM Approval Guide; Current Edition.

E. FM 4991 - Approval Standard of Firestop Contractors; 2013.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. UL (FRD) - Fire Resistance Directory; Current Edition.

H. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

C. Qualification Data: For qualified Installer.

D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

F. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

G. Perform and submit reports of Code Required Special Inspections as required in Section 01 45 33.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer. Refer to FM 4991.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory." UL (FRD) and UL 263
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products." ITS (DIR)
         3) FM Global in its "Building Materials Approval Guide." FM (AG)

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Specified Technologies, Inc.
   2. Grace Construction Products.
   3. Hilti, Inc.
   4. Johns Manville.
   5. Owen's Corning.
   6. RectorSeal Corporation.
   7. 3M Fire Protection Products.
   8. Tremco, Inc.; Tremco Fire Protection Systems Group.
   9. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is 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 construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Fire-resistance-rated walls include fire-barrier walls.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Horizontal assemblies include floors and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall. T-rating to be applied according to the standards of ASTM E119

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

E. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

c. Fire-rated form board.
d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.03 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended 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. Comply with UL 2079

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant. Comply with UL 1479.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

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 of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping 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

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

A. General: Install penetration firestopping 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 fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is 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 and install new materials to produce systems complying with specified requirements.

3.05 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestopping with No Penetrating Items:
   1. UL-Classified Systems: As indicated.

C. Firestopping for Metallic Pipes, Conduit, or Tubing:
   1. UL-Classified Systems: As indicated.

D. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
   1. UL-Classified Systems: As indicated.

E. Firestopping for Electrical Cables:
   1. UL-Classified Systems: As indicated.

F. Firestopping for Insulated Pipes:
   1. UL-Classified Systems: As indicated.

G. Firestopping for Miscellaneous Electrical Penetrants:
   1. UL-Classified Systems: As indicated.

H. Firestopping for Miscellaneous Mechanical Penetrants:
   1. UL-Classified Systems: As indicated.

I. Firestopping for Groupings of Penetrants:
   1. UL-Classified Systems: As indicated.
   2. Intertek ETL SEMKO-Listed Systems.
   3. FM Global-Approved Systems.
   4. F-Rating: 2 hours.
   5. T-Rating: 2 hours.
   6. L-Rating at Ambient: As indicated.
   7. L-Rating at 400 deg F (204 deg C): As indicated.
   8. Type of Fill Materials: As required to achieve rating.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hybrid joint sealants.
   2. Silicone joint sealants.
   3. Polyurethane joint sealants.
   4. Latex joint sealants.
   5. Acoustic Joint Sealants.
   6. Glazing Sealants.

B. See Section 13 11 15 for Sealants around Swimming Pools.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 45 00 - Precast Architectural Concrete.

E. Section 04 20 00 - Unit Masonry Assemblies.

F. Section 06 10 00 - Rough Carpentry.

G. Section 06 20 00 - Finish Carpentry.

H. Section 06 40 00 - Architectural Woodwork.

I. Section 06 64 00 - Plastic Paneling.

J. Section 07 08 00 - Commissioning of Thermal and Moisture Protection.

K. Section 07 21 00 - Thermal Insulation.

L. Section 07 24 19 - Water-Drainage Exterior Insulation and Finish System (EIFS).

M. Section 07 27 26 - Fluid-Applied Membrane Air Barrier.

N. Section 07 42 00 - Metal Wall Panels.

O. Section 07 54 23 - Thermoplastic Polyolefin (TPO) Roofing.

P. Section 07 62 00 - Sheet Metal Flashing and Trim.

Q. Section 07 72 33 - Roof Hatches.

R. Section 07 81 00 - Applied Fireproofing.

S. Section 07 84 00 - Firestopping.

T. Section 08 11 13 - Hollow Metal Doors and Frames.

U. Section 08 31 13 - Access Doors and Frames.

V. Section 08 33 23 - Overhead Coiling Doors.

W. Section 08 36 16 - Single Panel Doors.

X. Section 08 38 00 - Traffic Doors.

Y. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

Z. Section 08 81 00 - Glazing.

AA. Section 09 21 16 - Gypsum Board Assemblies.

BB. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

CC. Section 09 30 00 - Tiling.

DD. Section 13 11 15 - Swimming Pool Finishes.

1.03 REFERENCE STANDARDS

A. AAMA 802.3 - Specification for Ductile Back Bedding Glazing Compound.

B. AAMA 803.3 - Specification for Narrow Joint Seam Sealers.

C. AAMA 805.2 - Specification for Back Bedding Glazing Compound.

D. AAMA 808.3 - Specification for Exterior Perimeter Sealing Compound.

E. 21 CFR 177 - Indirect Food Additives: Polymers; Current ed..

F. ASTM C717 - Standard Terminology of Building Seals and Sealants; Current Edition.

G. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 2022.

H. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

I. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

J. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

K. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2023.

L. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

M. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

N. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

O. ASTM C1382 - Standard Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints; Current Ed..

P. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2023.

Q. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

R. ASTM D412 - Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

S. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness.

T. EIMA 300.01 - Determining Peel Adhesion and Tensile Adhesion Properties of Sealants Applied to EIFS Class PB.

U. Federal Specification TT-S-00227E - Sealing Compound, Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

V. Federal Specification TT-S-00230C - Sealing Component, Elastomeric Type, Single Component (for Caulking, Sealing, & Glazing in Buildings and Other Structures).

W. Federal Specification TT-S-001543A - Sealing Compound: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures).

X. Federal Specification TT-S-001543B - Sealing Compound: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures).

Y. GANA - Sealant Manual and Related GANA Publications.

Z. SWRI Sealant Manual and Related SWRI Publications.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Color Selection: Provide range of available colors for each sealant type as indicated on schedule below.

C. Mock Up. See drawings for requirements of Free Standing Mockup Panel. Provide selected color and types of sealants as applicable.
   1. Provide Mockups in accordance with ASTM C1521.
   2. If Mockup Panel is insufficiently large to show all required sealants, these additional sealants shall be mockuped in place.

D. 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 and color.

E. Qualification Data: see Section 01 40 00.

F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Preconstruction 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.

I. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

J. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

D. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

F. Pre-Installation Conference: Conduct conference at Project site.
   1. Field adhesion testing required. Sealant adhesive testing to all substrates to verify surface preparation, priming, etc. Submit the results of the on-site adhesion testing. (Perform project specific adhesion testing of the joint sealants for all surfaces to receive sealant)

1.06 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 joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: (From date of Substantial Completion)
      a. Silicone, Urethane and Latex: Two (2) years.
      b. Hybrid Sealants: Ten (10) years.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: (From date of Substantial Completion)
      a. Silicone, Urethane and Latex: Two (2) years.
      b. Hybrid Sealants: Ten (10) years.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Definitions: All terms in this section are defined by ASTM C717.

B. Compatibility: Provide joint sealants, backings, 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.

C. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type (ASTM C639), grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range. See Schedule for number of colors.

2.02 HYBRID JOINT SEALANTS (SLNT-1)

A. High performance, Low modulus, High movement, Non-sag, Fast curing, Hybrid Joint Sealant: ASTM C920. Type S, Grade NS, Class 50. ASTM C1382 for use with EIFS wall systems at 100% extension.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Tremco Dymonic FC.
      b. Sika Hyflex 150 LM
      c. Or approved substitution.

2.03 SILICONE JOINT SEALANTS

A. Plumbing and Bathroom Sealant **(SLNT-2)** Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786 Mildew Resistant.
      b. GE Advanced Materials - Silicones; 2* Kitchen and Bath.
      c. Tremco Incorporated; Tremsil 200 Sanitary.
      d. Or approved equal.

B. General Use Interior Sealant **(SLNT-7)** Single Component, General Purpose Acetoxy Cure Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25 for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sikasil GP
      b. Tremco, Tremsil 200
      c. Dow Corning Corporation, Dowsil General Purpose Sealant
      d. Or approved equal.

2.04 URETHANE JOINT SEALANTS (SLNT-3)

A. Single-Component, Non-sag, Traffic-Grade, Self Leveling, Polyurethane Joint Sealant: ASTM C920. Type S, Grade NS, Class 25, for Use T.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sika Sikaflex 15LM
      b. Pecora Corporation; Urexpan NR-200.
      c. Tremco Vulkem 45SSL

2.05 LATEX JOINT SEALANTS (SLNT-4)

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; AC-20+.
      b. Tremco Incorporated; Tremflex 834.

2.06 ACOUSTIC JOINT SEALANTS (SLNT-5)

A. Acoustic Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex acoustical sealant complying with ASTM C834.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric, LLC; "BOSS 826 Acoustical Sound Sealant".
      b. Grabber Construction Products; "Acoustical Sealant GSC".
      c. OSI; "SC-175 Acoustic Sound Sealant".

2.07 GLAZING SEALANTS (SLNT-6)

A. Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C1184, Type S, Grade NS, Class 50, for Use G. Color: As selected by Architect.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 791, 795, 995, or 999-A.
      b. GE Advanced Materials - Silicones; SilGlaze II SCS2800, SilPruf NB SCS900,0 SilPruf SCS2000, and UltraPruf II SCS2900.
      c. Pecora Corporation; 864.
      d. Tremco Incorporated; Spectrem 2 or Spectrem 3.

B. See Section 08 81 00 Glazing.

2.08 SEALANTS FOR EIFS.

A. See Section 07 24 19 Water Drainage Insulation and Finish System.

2.09 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers as defined by ASTM C719; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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. Provide self-adhesive tape where applicable. Provide backer rod sizes approximately 20% in excess of joint width.

2.10 MISCELLANEOUS MATERIALS

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 nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Adhesion testing in compliance with Section 1.3 Part E-1 of this section.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including 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. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous 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. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.

c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer including recommended cure times and special instructions/ materials for porous substrates or as indicated by 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.

C. 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.

3.03 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 and for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind 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 sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints. Avoid three sided adhesion for all sealant joints.

E. 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 in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: 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.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 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 so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. (SLNT-1) Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in exterior insulation and finish systems.
      d. Joints between metal panels.
      e. Secondary exterior sealant at joints around windows, storefronts and curtain walls.
      f. Joints between different materials listed above.
      g. Perimeter joints between materials listed above and frames of doors windows and louvers.
      h. Other joints as indicated.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
      a. Assume (1) color for each material transition. (eg: Brick to Metal panel, EIFS to Brick, etc)

B. (SLNT-2) Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Joints around toilet accessories.
      c. Joints between mirrors and adjacent material.
      d. Joints at countertops to walls.
      e. Tile control and expansion joints where indicated.
      f. Around access panels and penetrations in natatorium, locker rooms, toilet rooms, pump rooms, and any other room where moisture will be present.
      g. Other joints as indicated.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors, Clear, White.

C. (SLNT-3) Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in stone flooring.
      c. Control and expansion joints in tile flooring.
      d. Other joints as indicated.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
      a. Assume (1) color for each material transition. (eg: Tile to concrete, each tile color, etc)

D. (SLNT-4) Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
      e. Joints between stone or tile wall and ceiling finishes and wall coverings.
      f. Joints around access panels and fire extinguisher cabinets in dry locations. (where panels are located in a wet area, such as a locker room, natatorium, wet spa, kitchen, bathroom, etc, use SLNT-2 above)
      g. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      h. Other joints as indicated.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
      a. Assume (1) color for each material transition. (eg: Metal Frame to wall, each tile color, etc)

E. (SLNT-5) Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces at Acoustical Separation Walls.
   1. Joint Locations:
      a. All joints between, around and through acoustic walls and ceilings as shown on plan.
      b. Other joints as indicated.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
      a. Assume (1) color for each material transition. (eg: Metal Frame to wall, each tile color, etc)

F. (SLNT-6) Glazing Sealant Application: Apply according to ASTM C1401. See Section 08 81 00.
   1. Joint Locations:
      a. Around Glazing, according to ASTM C1401.
      b. Perimeter joints between materials listed above and frames of doors, windows and louvers (Primary Seal).

G. (SLNT-7) General Use Interior Sealant: Use at interior joints between dissimilar materials where no other above sealant applies:
   1. Joint Locations:
      a. Between casework and walls. (where casework is located in a wet area, such as a locker room, natatorium, wet spa, kitchen, bathroom, etc, use SLNT-2 above)
      b. Between wall covering and bases or ceilings where edges of wall covering would otherwise be exposed.
      c. Between light fixtures and supporting wall/ceiling, when exposed to view. (where light fixture is located in a wet area, such as a locker room, natatorium, wet spa, kitchen, bathroom, etc, use SLNT-2 above)
      d. Around mirrors in exercise areas and studios. See SLNT-2 above for other mirrors.
      e. Between stone countertops, benchtops, sills etc and casework and walls.
      f. Where aesthetic sealants are indicated on drawings.
   2. Joint-Sealant Color: Clear, typ.

H. See Section 13 11 15 for Sealants around Swimming Pools.

END OF SECTION

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SECTION 07 95 00
PREFORMED TRAFFIC DURABLE SEALANT SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Preformed traffic durable sealant systems and accessories.

1.02 RELATED WORK

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 41 00 - Precast Structural Concrete.

E. Section 07 92 00 - Joint Sealants.

F. Section 32 13 13 - Concrete Paving.

G. Section 32 14 00 - Unit Paving.

1.03 REFERENCES

A. ASTM C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

B. ASTM D545: Standard Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types)

C. ASTM D624: Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D. ASTM D3575: Standard Test Methods for Flexible Cellular Materials Made From Olefin Polymers.

E. AASHTO T42: Standard Method of Test for Preformed Expansion Joint Filler for Concrete Construction

1.04 SUBMITTALS

A. General - Submit the following according to Section 01 33 00 - Submittal Procedures.

B. Product information and independent lab test results.

C. Shop Drawing - Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, corners, expansion joint opening dimensions.

D. Material sample and color selector.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store all products according to Manufacturer's recommendations. Allow product to equalize with ambient temperature prior to installation.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer's qualifications. Installer must be ISO-9001 certified and approved by product manufacturer.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. General: Provide traffic durable, watertight, UV stable expansion joint for isolation joints in concrete structures and paving.

1. Typical locations include, but are not limited to the following: joints over occupied space, below-grade, stair tower perimeters, elevator perimeters, curbs, parking deck joints, and structural expansion joints.
2. System shall perform waterproofing, traffic bearing and movement-accommodation functions as the result of a single installation and without the addition of gutters, vapor barriers, bladders, or other devices suspended beneath or within the system in any way.
3. System shall be heat stable for a range of -40F to 150F without any bleeding of material. Material shall be capable of expansion after being subjected to extreme temperatures.

B. Traffic Sealant: Low density, closed cell, cross linked polymer joint seal. Acceptable Manufacturers and products:
1. **TSLNT-2**: Low density closed cell joint seal bonded with expoxy adhesive:
a. Watson, Bowman, Acme, Wabo Evazote UV
b. Or approved substitution.
2. Color: To be selected by Architect from Manufacturer's full range.

2.02 ACCESSORIES

A. Adhesive as supplied by product manufacturer.

B. Provide Factory-manufacturered bends for directional changes. Butting two non-bended units together at corners is not acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation of the Work Area:
1. Verify that joint opening matches the manufacturer's recommended range for selected product. Report discrepencies to Architect/Engineer and adjust sealant sizes as directed.
2. Clean joint opening of all contaminants before installation.
3. Repair spalled, irregular or unsound joint surfaces using accepted industry practices. Smooth sides to meet Manufacturer's installation standards.
4. Verify all surfaces meet Manufacturer's requirements to the full depth of the installation.

B. Installation of Product:
1. Use only Manufacturer's adhesive.
2. Do not install if temperature, humidity or weather are outside the range recommended by Manufacturer.
3. Do not drill, screw or use fasteners of any type.
4. Install so that the finished product is flush with the traffic surface.
5. Precompress joint material to size smaller than joint prior to installation.
6. Conform to all Manufacturer's instructions.

3.02 CLEAN AND PROTECT

A. Protect the system and its components during construction.

B. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION

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SECTION 08 00 10
DIVISION 8 TABLE OF CONTENTS

DIVISION 08 – OPENINGS

08 08 00 - Commissioning of Openings
08 11 13 - Hollow Metal Doors and Frames
08 11 16 - Aluminum Doors and Frames
08 14 16 - Flush Wood Doors
08 31 13 - Access Doors and Frames
08 33 23 - Overhead Coiling Doors
08 38 00 - Traffic Doors
08 41 13 - Aluminum Framed Entrances and Storefronts
08 44 13 - Glazed Aluminum Curtainwalls
08 71 00 - Door Hardware
08 81 00 - Glazing
08 87 13 - Solar Control Film

END OF SECTION

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SECTION 08 08 00
COMMISSIONING OF OPENINGS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

D. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

E. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections, but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Hollow Metal Doors and Frames
   2. Coiling Overhead Doors
   3. Aluminum Framed Entrances and Storefronts
   4. Glazed Aluminum Curtainwalls
   5. Door Hardware
   6. Automatic Door Operators
   7. Glazing

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-rated and fire rated steel doors.
   2. Non-rated and fire rated steel frames.
   3. Accessories:
      a. Glazing stops.
      b. Louvers.
      c. Astragals.
      d. Misc Accessories.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements

D. Section 04 20 00 - Unit Masonry.

E. Section 06 10 00 - Rough Carpentry.

F. Section 06 20 00 - Finish Carpentry.

G. Section 07 92 00 - Joint Sealants.

H. Section 08 08 00 - Commissioning of Openings.

I. Section 08 14 16 - Flush Wood Doors.

J. Section 08 71 00 - Door Hardware.

K. Section 08 81 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Useable by Physically Handicapped People.; 2009.

B. ANSI/DHI A115 - Wood Door Hardware Standards: Hardware Preparation; Current Edition, Including All Revisions.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

F. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames; 2022.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

I. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2023.

J. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

K. ICC A117.1-2009 - Accessible and Usable Buildings and Facilities; 2009.

L. ITS (DIR) - Directory of Listed Products; Current Edition.

M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

N. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

P. SDI 111 - Recommended Details for Standard Steel Doors, Frames, and Accessories; 2025.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI A250.8, SDI 111, SDI 117 and as herein specified.

C. Fire rated door and frame construction to conform to NFPA 252.

D. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated in Schedule.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated frames and doors.
   1. Where fire rated doors are indicated on the Door Schedule, doors shall comply with the requirements of UL 10C for positive pressure requirements. Door assemblies shall bear a fire-rating label issued by a listing agency showing the hourly fire rating followed by the letter “S”.

B. All doors to conform to Accessibility Standards of ICC A117.1-2009.

1.07 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00-Submittal Requirements.
   1. Shop Drawings:
      a. Provide schedule of doors and frames using same opening numbers referenced on the drawings.
      b. Indicate frame gage and configuration, fire label, anchor types and spacing, location of cutouts for hardware, and reinforcement.
      c. Indicate door elevations, hardware group, core material, internal reinforcement, closure method, and cut outs for glazing and louvers.
   2. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
   3. Procurement:
      a. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
      b. Submit inventory to Owner within 5 days of delivery of materials.
      c. See Sections 01 33 00 and 01 60 00.

1.08 DELIVERY, STORAGE AND PROTECTION

A. Protect products under provisions of Section 01 60 00 - Product Requirements.
   1. Protect doors and frames with resilient packaging sealed with heat shrunk plastic.
   2. Break seal on-site to permit ventilation.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty for defects in workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products from 1 of the following:
   1. Amweld Building Products, Inc.
   2. Ceco Corporation.
   3. Curries Mfg., Inc.
   4. Republic Builders Products Corp.
   5. Steelcraft Mfg. Co.
   6. Approved substitution from SDI Member as approved by the Architect.

2.02 STEEL DOORS

A. Exterior Doors: ANSI/SDI A250.8 Level 3, Model 2; minimum 16 gage zinc-iron alloy-coated Galvannealed steel sheet faces complying with ASTM A653/A653M A60 seamless, composite construction; polystyrene or polyurethane foam core bonded to the inside of both faces. Exterior doors shall have a minimum operable "U" value of 0.34 meeting requirements of ASTM C1364.

B. Interior Non-Fire-Rated Doors: ANSI/SDI A250.8 Level 2, Model 2; minimum 18 gage cold rolled steel sheet complying with ASTM A1008/A1008M seamless, composite construction; honeycomb core laminated to the inside of both face sheets.

C. Interior Fire-Rated Stairwell Doors: ANSI/SDI A250.8 Level 2, Model 2; minimum 18 gage cold rolled steel sheet complying with ASTM A1008/A1008M; seamless, composite construction; temperature rise door.
   1. Provide interior fire-rated doors with UL label as indicated on Room Opening Schedule.

D. Interior Fire-Rated Doors: ANSI/SDI A250.8 Level 2, Model 2; minimum 18 gage cold rolled steel sheet complying with ASTM A1008/A1008M; seamless, composite construction; temperature rise door with mineral fiber core.
   1. Provide interior fire-rated doors with UL label as indicated on Room Opening Schedule.

2.03 STEEL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Exterior Frames: Metallic-coated steel sheet, minimum 14 gauge, ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum A60 (Z180) zinc-iron alloy-coated Galvannealed coating. Frame profiles shall include a thermal barrier at the frame soffit providing a positive thermal break within the frame profile.

C. Interior Frames: Cold-rolled steel sheet, minimum 16 gauge ASTM A1008/A1008M, CS, Type B; suitable for exposed applications.

D. Interior frames in high humidity, moisture areas (Locker rooms, shower areas, pool areas ect.): Metallic-coated steel sheet, minimum 14 gauge, ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum A60 (Z180) zinc-iron alloy-coated Galvannealed coating.

E. Hardware Reinforcement: Fabricate per ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.04 ACCESSORIES

A. Glazing Stops: Rolled steel channel shape, mitered or butted corners; prepared for countersink style tamperproof screws.

B. Louvers: Manufacturer's standard roll formed steel material, wiped coat of zinc; inverted 'Y' blade, sight proof; standard frame with surface tamperproof fasteners; prime painted finish.

C. Astragals: Provide “Z” style astragals at pairs of doors as required by hardware application. Flat bar astragals are not allowed.

D. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

E. Rubber Silencers: Resilient rubber.

F. Sill Pan W/ Back Dams: Pemko 2008 PK.

2.05 FABRICATION

A. Tolerances: Fabricate hollow metal Work to tolerances indicated in SDI 117.

B. Fabricate frames with saw miter or saw butt end corner construction. Joints are to be die-mitered with integral tabs for reinforcement and interlocking of the jambs to the head. Grind exposed welds and surfaces smooth with no joints visible anywhere on the face of frame.

C. Provide frames of required throat depth for wall thickness.

D. Hardware Preparation: Factory prepare hollow metal Work to receive templated mortised hardware per Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - Door Hardware.
   1. Locate hardware as indicated, or if not indicated, per ANSI/SDI A250.8 and DHI (LOCS).
   2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal Work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 electrical Sections.

E. Where grouting or mortar filled frames and frames in high humidity, moisture areas (Locker rooms, shower areas, pool areas etc.) are specified, or where antifreeze additive are used in fill, protect inside throat of each frame with a waterproof undercoating type material, minimum 1/8 inch thick.

F. Fabricate doors without seams on faces or vertical edges of door. Continuously weld vertical edge seams, and grind smooth.

G. Reinforce frames wider than 48" with roll formed steel channels fitted tightly into frame head, flush with top.

H. Prepare frame for silencers. Provide three single rubber silencers on strike jamb for single doors, two single rubber silencers on strike jamb of ½ height doors and two single silencers on frame head at double doors.

I. Attach metal fire rated label to each frame and door unit, where required.

J. Reinforce top and bottom edges with a 14 gauge channel welded to face sheets.

K. Close top edge of exterior door flush with inverted 16 gauge steel channel closure. Seal joints watertight.

L. Provide fixed glazing stops on outside of exterior doors and on secure side of interior doors.

M. Provide screw-applied, removable glazing beads on inside of glass, louvers and other panels in doors.

N. Provide shipping separation panel for all exterior door frames with ½” plywood spacer panel, two feet high by width of frame to maintain integrity of frame width during shipping and installation.

2.06 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating. Apply primer uniformly inside and outside of frame, and under removable stops and trim.

1. Shop Primer: ANSI/SDI A250.10.
2. Final Finish: Refer to door schedule, submit all finishes to architect for approval.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install hollow metal Work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames per NFPA 80.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
      b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (10 mm).
      d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
   2. Fire-Rated Doors: Install doors with clearances per NFPA 80.
   3. Smoke-Control Doors: Install doors per NFPA 105.

D. Glazing: Comply with requirements in Section 08 81 00 - Glass Glazing and with hollow metal manufacturer's written instructions.
   1. Glaze doors at factory or in supplier shop with glass of type and thickness indicated on Drawings. Coordinate with Section 08 81 00 for glass types. Install glass as recommended by manufacturer and in compliance with ITS (DIR) - Warnock Hersey or UL approved glazing system.
   2. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (229 mm) on center and not more than 2 inches (51 mm) on center from each corner.

E. Coordinate with masonry and wallboard wall construction for anchor placement.
   1. Masonry Construction: Install frames up to 60" high in masonry construction with minimum 2 jamb anchors each jamb; add an additional anchor for every 30" or fraction thereof.
   2. Wallboard Construction: Install frames up to 60" high in wallboard construction with minimum 3 jamb anchors each jamb; add an additional anchor for every 24" or fraction thereof.

F. Coordinate installation of glass and glazing.

3.02 TOLERANCES

A. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. 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.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   3. 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.
   4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.03 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave Work in complete and proper operating condition. Remove and replace defective Work, including hollow metal Work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal Work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors.

B. Rated wood doors.

C. Pre-fitting and pre-machining for hardware.

D. Factory pre-finishing wood doors.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 04 20 00 - Unit Masonry.

E. Section 06 10 00 - Rough Carpentry.

F. Section 06 20 00 - Finish Carpentry.

G. Section 08 71 00 - Door Hardware.

H. Section 08 81 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 American National Standard for Basic Hardboard.

B. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).

C. AWI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

G. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

H. ASTM E84 Standard Test Method for Surface Burning.

I. AWI (QCP) American Wood Institute Quality Certification Program.

J. AWI/AWMAC/WI (AWS) American Wood Institute Architectural Wood Standards.

K. AWMAC (GIS) Architectural Woodwork Standards.

L. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S. 1A, "Architectural Wood Flush Doors. AWI (AWS) "Architectural Woodwork Quality Standards Illustrated."

D. Fire-Rated Wood Doors: Doors 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 per NFPA 252 or UL 10C.
   1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F (250 degrees C) above ambient after 30 minutes of standard fire-test exposure.

E. Factory Finishing of Doors: Arrange with Owner to remove at least 1 existing wood door for the purpose of storing at wood door factory as a basis for matching existing stain and finish. Select appropriate door with Architect’s direction.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated doors.

B. Furnish manufacturer's appropriate listed door to maintain rated assembly, including compatibility with specified hardware.

C. Where fire rated doors are indicated on the Door Schedule, doors shall comply with the requirements of UL 10C for positive pressure requirements. Door assemblies shall bear a fire-rating label issued by a listing agency showing the hourly fire rating followed by the letter “S”.

1.07 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 30 00- Submittals:
   1. Shop Drawings: Indicate elevations for each door type, location, size, fire ratings, swing, undercuts, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.
   2. Product Data: Submit product data for each type of door specified.
   3. Samples: Submit four (4) 12” x 12” samples of factory finishing for approval.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

C. Closeout Submittals: Submit the following under provisions of Section 01 77 00 - Contract Closeout.
   1. Warranty.
   2. Operation and Maintenance information.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
   1. Stack wood doors as recommended by door manufacturer.
   2. Use opaque plastic sheeting for natural finished doors.

C. Mark each door on top and bottom with a label from the manufacturer indicating the following: Opening number used on Shop Drawings, door construction, face veneer species, cut and grade. If factory finished, include finishing information.

D. Do not deliver doors until building is enclosed, warm, dry, and at design humidity levels, and painting Subcontractors are on Project site ready to apply finish immediately after delivery.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: 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 ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.10 WARRANTY

A. Warranty: Provide written warranty signed by door manufacturer, installer and Contractor agreeing to replace defective doors. Door defects include, but are not limited to the following:
   1. Delamination in any degree.
   2. Warp or twist of 1/4" or more in any door panel.
   3. Telegraphing of any part of core assembly through face veneer to cause surface variation of 1/100" or more in a 3" span.
   4. Other defects which affect performance of door.

B. Warranty shall cover the cost of refinishing, installation of hardware and re-hanging defective doors. Warranty shall be in effect for the following time periods:
   1. Interior Solid Core Doors: For the life of the installation.

PART 2 PRODUCTS

2.01 FLUSH SOLID CORE INTERIOR WOOD DOORS

A. Flush 5-ply door construction with solid particle core, urea-formaldehyde free bonded to stiles and rails using Type 1 waterproof glue.
   1. Quality Grade: AWI Premium.
   2. Door Thickness: 1-3/4” thick.
   3. Acceptable Manufacturers:
      a. Oshkosh Architectural Door Company.
      b. Masonite Architectural.
      c. VT Industries.

B. Non-Rated Doors:
   1. Quality Type: AWI Type PC-5.
   2. Stiles: 2-ply, 1-1/4″ thick after trimming laminated stiles. Outer ply 1/4" hardwood to match veneer face; inner ply 1-1/8 ″mill option hardwood or softwood.
   3. Rails: 1-1/8" thick mill option hardwood or softwood. Thicker as required for hardware concealed fastener.
   4. Acceptable Products:
      a. Masonite Architectural "Aspiro."
      b. VT "Heritage Collection."
      c. Oshkosh “GP5V”.

C. 20 Minute Doors:
   1. Quality Type: AWI Type FD 1/3; and complying to UL10C positive pressure requirements.
   2. Stiles: 2-ply, minimum 5-1/2" thick laminated stiles after trimming. Outer ply 3/4" hardwood to match veneer face; inner ply mill option hardwood or softwood.
   3. Top Rail: Minimum 5-1/2" thick mill option lumber.
   4. Acceptable Products:
      a. Masonite Architectural "Aspiro," 20 Minute.
      b. VT "Heritage Collection," 20 Minute.
      c. Oshkosh “GP5V”, 20 Minute.

D. 3/4 and 1-1/2 Hour Doors:
   1. Quality Type: AWI Type FD 3/4 or Type FD 1 as indicated on Door Schedule; and complying to UL10C positive pressure requirements with intumescent seals concealed by outer stile (Category A).

2. Stiles: Provide wood door manufacturer's standard laminated edge construction capable of withstanding a minimum of 740 pounds of pull per screw when tested in accordance with ASTM D1037.
3. Top Rail: 5-1/2” minimum thick mill option lumber.
4. Bottom Rail: 1-1/8" thick mill option hardwood or softwood.
5. Internal Reinforcement:
    1) Lock Blocks: 5-1/2" x 12" minimum mill option lumber. Provide two blocks for doors scheduled to receive exit devices.
    2) Flush Bolts: Provide 5-1/2" x 12" lumber reinforcement at flush bolt locations.
6. Acceptable Products:
    a. Masonite Architectural "Aspiro," 45 and 60 Minute.
    b. VT "Heritage Collection," 45 and 60 Minute.
    c. Oshkosh “GF5V”, 45 and 60 Minute.

2.02 FACE VENEER

A. Veneer: AWI Grade A, 1/50" thick minimum veneer thickness prior to sanding.
1. Species: Walnut, stain to match PLAM-34. See Door Schedule and Section 06 40 00 – Architectural Woodwork.
2. Cut: Plain sliced (Flat Cut).
3. Matching between Individual Pieces of Veneer: Book match.
4. Assembly of Spliced Veneer on Face: Balance match (5 pieces maximum).

2.03 ACCESSORIES

A. Glass Stops: Square, beveled, to be provided by door manufacturer to match door species and finish and provide required fire rating.

2.04 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Fabricate fire rated doors in accordance with AWI Quality Standards and UL requirements. Permanently attach UL fire rating label to door edge of all fire rated doors. Provide S-Label where indicated on Door Schedule.

C. Provide non-rated and 20 minute rated flush doors with 1-3/8" thick minimum, 2-ply edge bands, with outer ply 1/2" thick minimum edge strips of wood species to match face veneer or as otherwise required to comply with UBC

D. Provide fire rated doors with ratings greater than 20 minute with manufacturer's laminated edge construction to provide specified screw holding capability.

E. Provide minimum 5” top blocking, sill blocking and lock block on all doors. Provide 10” high intermediate blocking on all doors when exit devices are specified.

F. Pre-fit and pre-machine doors for finish hardware, except for hardware items considered to be surface mounted, as specified in Section 08 71 00. Comply with AWI Section 01 30 00 for factory pre-fitting and pre-machining.

G. Bevel strike edge of double doors 1/8” in 2”. Radius strike edge of double acting swing doors.

H. Seal cutouts prior to installation of moldings or stops.

2.05 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all 4 edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI conversion varnish catalyzed polyurethane system.
3. Staining: Custom match to millwork. Contact LT to obtain control sample. Provide stain match samples to architect for approval.
4. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 - Door Hardware.

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames per NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/4 inch (18 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
      a. Comply with NFPA 80 for fire-rated doors.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
   3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely. If door cannot be made to operate properly, remove and install new door.

B. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.
   1. Remove doors damaged during installation and install new doors.

C. 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.
   1. Restore finish before installation, if fitting or machining is required at Project site.

END OF SECTION

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for walls and ceilings.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 01 60 00 - Product Requirements.
D. Section 06 10 00 - Rough Carpentry.
E. Section 06 20 00 - Finish Carpentry.
F. Section 06 64 00 - Plastic Paneling.
G. Section 08 71 00 - Door Hardware.
H. Section 09 21 16 - Gypsum Board Assemblies.
I. Section 09 30 00 - Tiling.
J. Section 09 91 00 - Painting.
K. Div 21 - Fire Suppression.
L. Div 22 - Plumbing.
M. Div 23 - HVAC.
N. Div 25 - Automation.
O. Div 26 - Electrical.
P. Div 27 - Communications.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
F. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2022a.
G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
H. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
I. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
J. SSPC-SP 5 - White Metal Blast Cleaning; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Keying: Determine keying requirements for preparation of final keying schedule.
   2. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

1.05 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. 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.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.07 COORDINATION

A. 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

2.01 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
   1. ASTM A123/A123M, for galvanizing steel and iron products.
   2. ASTM A153/A153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, 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 A924/A924M.

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 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 A780/A780M.

a. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Acudor Products, Inc.
   2. Babcock-Davis.
   3. Cendrex Inc.
   4. Cesco.
   5. Dur-Red Products.
   6. Elmdor/Stoneman.
   7. Karp Associates, Inc.
   8. Larsen's Manufacturing Company.
   9. MIFAB, Inc.
   10. Milcor Inc.
   11. Nystrom, Inc.
   12. Williams Bros. Corporation of America (The).

B. Recessed Access Door / Drywall Panel Door.
   1. Locations: Wall and ceiling surfaces, see plans and elevations.
   2. Door: Minimum 0.060 inch (1.5 mm) thick sheet metal.
   3. Frame: Minimum 0.060 inch (1.5-mm) thick sheet metal with 1-1/4 inch (32-mm) wide, recessed trim.
   4. Hinges: Continuous piano.
   5. Lock: Cylinder.
      a. Lock Preparation: Section 08 71 00 - Door Hardware.

C. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
   1. Locations: Wall and ceiling surfaces.
   2. Door: Minimum 0.060 inch (1.5 mm) thick sheet metal.
   3. Frame: Minimum 0.060 inch (1.5-mm) thick sheet metal with 1-1/4 inch (32-mm) wide, surface-mounted trim.
   4. Hinges: Continuous piano.
   5. Lock: Cylinder.
      a. Lock Preparation: Section 08 71 00 - Door Hardware.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
   1. Locations: Wall and ceiling surfaces.
   2. Fire-Resistance Rating: Not less than that of adjacent construction.
   3. Temperature Rise Rating: 250 degrees F (139 degrees C) at the end of 30 minutes.
   4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
   5. Frame: Minimum 0.060 inch (1.5 mm) thick sheet metal with 1 inch (25 mm) wide, surface-mounted trim.
   6. Hinges: Continuous piano.
   7. Automatic Closer: Spring type.
   8. Lock: Self-latching device with cylinder lock.

E. Tile-ready Recessed Access door.
   1. Locations: Tiled Walls and Ceilings, only where indicated. Typical access doors for tiled areas are flush.
   2. Size: Coordinate size with access requirements and tile size. Provide larger panel than needed for access to time out with tile pattern if necessary.

3. Door: Aluminum extrusion with tile backer fitted in door panel.
4. Frame: Aluminum extrusion 6063-T6 recessed to provide similar edge to allow for even finishing of wall or ceiling surface.
5. Hinge: Wing hinge with 90 degree opening with removable door.
6. Gasket: Dust Gasket.
7. Lock: Cylinder.
    a. Lock Preparation: Section 08 71 00 - Door Hardware.

2.03 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. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
    2. Provide mounting holes in frames for attachment of units to metal or wood framing.
    3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
    1. For cylinder lock, furnish 2 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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

D. Paint access panels according to the wall finish; see section 09 91 00.

3.02 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.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Uninsulated Overhead Coiling Doors.

1.02 GENERAL REQUIREMENTS

A. Provide all materials, labor, equipment and services necessary to furnish, deliver and install all work under this section as shown on the contract documents, specified herein, and as specified by the job conditions.

1.03 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 06 10 00 - Rough Carpentry.

F. Section 08 08 00 - Commissioning of Openings.

G. Section 08 71 00 - Door Hardware.

H. Section 09 21 16 - Gypsum Board Assemblies.

I. Division 26 - For electrical wiring connections.

1.04 REFERENCE STANDARDS

A. ANSI/DASMA 203 - STANDARD FOR NON-FIRE RATED ROLLING DOORS; Current Edition.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

1.05 PERFORMANCE REQUIREMENTS

A. General Performance: Coiling door systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Structural Loads:
      a. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category, Exposure Category, and Internal Pressure Coefficient indicated on Structural Drawings.
         1) Use exterior wall forces from table showing components and cladding ultimate wind pressure.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

1.07 SUBMITTALS

A. Procedures: Furnish submittals in accordance with the general requirements specified in 01 33 00.

B. Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each coiling service door.
   1. For each door, denote forces required to be supported by building at door jambs, including:
      a. Forces parallel to doors with required moment at support.
      b. Forces perprendicular to doors with required moment at support.

C. Product Literature: Submit manufacturer's technical literature describing the product to be used under this section.

D. Samples: Submit two slats, two by four inches in size illustrating shape, color and finish texture.

E. Pre-Warranty Submittal: Submit “Sample” warranty from membrane manufacturer. Sample warranty shall include manufacturer’s warranty number, duration of warranty, name of project, address of project, and shall identify the roofing contractor and describe the materials and assembly to be installed by this contractor.

F. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

G. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all coiling service doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product. See Section 01 92 00 - Facility Operation and Maintenance.

1.08 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.

C. Manufacturer Requirements: Coiling service door manufacturer shall have been in the business of and have experience in manufacturing the type of product covered under this specification section as well as giving credible service for a minimum of five (5) years. Provide list of at least ten (10) completed projects which include the products covered under this section.

1.09 DELIVERY, STORAGE AND HANDLING

A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

1.10 WARRANTY

A. Coiling Service Door Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

PART 2 PRODUCTS

2.01 OVERHEAD COILING DOORS

A. Provide Overhead Coiling Doors that comply with the standards of ANSI/DASMA 203

B. Acceptable Manufacturers and Products:
   1. Cornell Iron Works, Inc.
      a. Uninsulated Coiling Door: ESD10

2. McKeon Door Company.
   a. Uninsulated Coiling Door: SD3020-M-G
3. Wayne Dalton.
   a. Uninsulated Coiling Door: Model 800
4. Or approved substitution.

2.02 MATERIALS

A. Curtain: Shall be assembled of interlocking galvanized steel slats, cold rolled ASTM A123/A123M. Slats shall have endlocks locking each end of alternate slats to act as a wearing surface, and maintain slat alignment. Curtain shall be 20 gauge minimum.
   1. Slats: Shall be of a cross section not less than 3" wide by 7/8" deep.

B. Guides: Each guide assembly shall be fabricated of a minimum 2 1/4" x 2 1/4" extruded aluminum profiles.

C. Mounting Brackets: Fabricated of hot rolled 3/16” steel plate minimum, brackets shall be provided to house ends of the counterbalance barrel assembly.

D. Counterbalance Assembly: Coiling service door shall be counterbalanced by means of adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks or rings for attachment of curtain. Grease sealed bearings or self-lubricating graphite bearings shall be attached to the spring barrel which shall be fabricated of hot formed structural quality carbon steel seamless pipe.

E. Electric Motor Operator: Coiling service door shall be provided with a compact power unit designed and built by the coiling service door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency gearing running in an oil bath, shall be furnished together with a magnetic operated brake, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure. Provide system that complies with NEMA ICS 2 and NEMA EN 10250.
   1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation. Horsepower of motor is to be 1/3hp minimum or of manufacturer's recommended size, which ever is greater.
   2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.
   3. Reducer: Spiral gear type, 70% efficiency minimum.
   4. Brake: Magnetically activated, integral within the operator's housing.
   5. Control Station: Provide recessed, flush-mount push button control station marked open, close and stop, to control all doors with single operation.

F. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Slats are to receive a prime coat finish of .2 mils of epoxy primer and .8 mils of polyester paint. Color to match bronze hollow metal frames, submit samples to architect of standard available finishes for approval.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.

B. Verify all dimensions taken at job site affecting the work. Notify the Architect in any instance where dimensions vary.

C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

3.02 INSTALLATION

A. Perform installation using only factory approved and certified representatives of the coiling service door manufacturer.

B. Install coiling service door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.

C. Adjust coiling service door installation to provide uniform clearances and smooth non-binding operation.

D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.

3.03 PROTECTION AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.

B. Remove, repair or replace materials which have been damaged in any way.

C. Clean surfaces of grime and dirt using products and methods recommended by manufacturer. See 01 77 00 - Closeout Procedures.

END OF SECTION

SECTION 08 38 00
TRAFFIC DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Traffic doors.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 06 10 00 - Rough Carpentry.

E. Section 06 64 00 - Plastic Paneling.

F. Section 08 71 00 - Door Hardware.

G. Section 09 21 16 - Gypsum Board Assemblies.

1.03 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.04 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00-Submittals:
   1. Shop Drawings: Indicate elevations, size, location, color and installation details.
   2. Product data.
   3. Samples: Submit sample for door cladding material for final color approval.
   4. Installation Instructions.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

PART 2 PRODUCTS

2.01 TRAFFIC DOORS

A. Rigid Traffic Door (Café): Double-acting, self-closing, 1 1/2" thick solid core door body with 0.032” thick decorative plastic laminate applied to both sides of door. Size as indicated on Drawings.
   1. Eliason Easy Swing Door Division, Model ENG-1.
   2. Finish: Non-standard, 0.032” thick decorative laminate finish. Color to match PLAM-19, or as selected by the Architect.
   3. Vision Panels: 9” x 14” vision panel glazed with clear acrylic.
   4. Hardware: Manufacturer's standard.
   5. Trim: Provide 18 gauge stainless steel edge trim and top hardware cover plates.
   6. Base Plates: 18” high stainless steel base plates both sides of door.
   7. Jamb Guards: 5” x 9” stainless steel welded assembly of ¼” steel.

B. Rigid Insulated Traffic Door (Bistro): Double-acting, self-closing, 3 3/4” thick, foamed-in-place monolithic door panel with an outer skin thickness of .125”. Core foam to be CFC-Free urethane foam, providing and R-Value of 25.
   1. Chase Doors, Model Durulite R25 Insulated Cooler Door. Or approved equal.
   2. Finish: Color to be “Beige” or as selected by the Architect from manufacturer’s standard colors.
   3. Vision Panel: 12”x18” triple pane polycarbonate.
   4. Hinge: By Manufacturer, double acting.
   5. Gasketing: Replaceable Perimeter edge gasketing.

6. Spring Bumpers: None.
7. Jamb Guard: 5”x18” Jamb Guard.
8. Push Plates: None.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify door openings are prepared with headers and floors level, jambs plumb, without projections, and of specified dimensions.

B. Verify jambs of frames are properly reinforced at hinge locations.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install traffic doors according to Manufacturer's installation instructions. Adjust and leave in good operating order.

3.03 PROTECTION

A. Protect door according as recommended by traffic door manufacturer to assure that doors will be without damage at time of Substantial Completion.

END OF SECTION

SECTION 08 41 13
ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior storefront framing.
   2. Interior storefront framing.
   3. Sealants.
   4. Hardware (refer to Section 08 71 00 for hardware set information)

1.02 DEFINITIONS

A. ADA Standards, 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."

1.03 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 05 12 00 - Structural Steel Framing.

F. Section 05 21 00 - Steel Joist Framing.

G. Section 05 31 00 - Steel Decking.

H. Section 06 10 00 - Rough Carpentry.

I. Section 07 21 00 - Thermal Insulation.

J. Section 07 27 26 - Fluid Applied Membrane Air Barriers.

K. Section 07 62 00 - Sheet Metal Flashing and Trim.

L. Section 07 84 00 - Firestopping.

M. Section 07 92 00 - Joint Sealants.

N. Section 08 08 00 - Commissioning of Openings

O. Section 08 71 00 - Door Hardware.

P. Section 08 81 00 - Glazing.

Q. Section 09 21 16 - Gypsum Board Assemblies.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

K. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

N. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

O. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

P. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

Q. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

R. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

S. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

T. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

U. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

V. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

W. SSPC-PS 12 - Guide to Zinc-Rich Coating Systems; Current Edition.

X. ADAAG Americans with Disabilities Act Accessibility Guidelines.

1.05 PERFORMANCE REQUIREMENTS

A. Prepare design drawings and calculations under seal of a Professional Structural Engineer licensed in the state/province of the project and fully experienced in the design of curtainwall framing systems.

B. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

d. Noise or vibration created by wind and by thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.
g. Failure of operating units.

C. Structural Loads:
1. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category, Exposure Category, and Internal Pressure Coefficient indicated on Structural Drawings.

D. Member Deflection:
1. For spans less than 13’-6”, limit member deflection to the flexure limit of glass in any direction, and maximum of L/175 of span or ¾ inch, whichever is less wand with full recovery.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, 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 fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 06 CFM/SF @ 6.24 psf (. (30.47 ksf/sq. m) of fixed wall area when tested according ASTM E283/E283M at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa). Operable door units shall not exceed 1.0 cfm/sq ft at 1.57 psf pressure differential.

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 8 lbf/sq. ft.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.60 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) 0.29 winter, when tested according to AAMA 1503.
1. Run thermal analysis of as-designed window installation with perimeter conditions to determine risk of interior condensation in wet areas.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
3. Provide full project specific structural calculations in compliance with referenced documents, all applicable codes and these specifications. Submit stamped calculations by P.E. including framing attachment and Insulated Glazing Units.

C. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (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.
   5. Flashing and drainage.

D. Material Finish Sample for review and approval by Architect prior to releasing windows for fabrication.

E. Sealant Color Samples for selection.

F. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the 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.

G. Qualification Data: For qualified Installer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements. Test reports shall be no more than five years old and shall apply to correct standards.

I. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

J. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

K. Warranties: Sample of special warranties.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

B. Pre-Installation Conference
   1. Convene a pre-installation conference under provisions of Section 01 31 00 - Project Management and Coordination prior to commencing work of this Section.
      a. Attendance required of Contractor, system installer, and parties directly affecting work of this Section.
      b. Review conditions of installation, installation procedures and coordination required with Related Work.
      c. Coordinate Keying, Compatibility and appearance of visible hardware with hardware provider.

1.08 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer’s qualifications: minimum of ten years of experience in the manufacture of similar glass and metal systems with success.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Minimum of five years of successful experience in the installation of systems similar to those required.

D. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' 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 preconstruction testing, field testing, and in-service performance.

F. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

G. Source Limitations for Aluminum-Framed Systems: Obtain each type and variety of aluminum, steel and wood hardware from the same manufacturer, unless otherwise indicated.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Test Mockup according to ASTM E783, ASTM E1105 spray wand testing to ensure performance.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Field Testing:
   1. Submit results of field tests as required in Part 3.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components.
   2. Warranty Period: 5 years from date of Substantial Completion.
   3. Sub-Contractor 2 year warranty for all work.

1.10 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

PART 2 PRODUCTS

2.01 EXTERIOR STOREFRONT

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tube Lite Storefront systems 14000, or comparable product by one of the following:
   1. EFCO Corporation.
   2. Kawneer North America.
   3. Oldcastle Building Envelope.
   4. Midland Glass Company.

5. CMI Architectural Products, Inc.
6. Or approved equal.

2.02 INTERIOR STOREFRONT

A. Provide Interior, non thermally broken storefront system for interior aluminum doors and frames from the same manufacturer as the Exterior storefront.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Tube Lite INT14 Interior Flush Glaze System. or comparable product by one of the following:
1. EFCO Corporation.
2. Kawneer North America.
3. Oldcastle Building Envelope.
4. Midland Glass Company.
5. CMI Architectural Products, Inc.
6. Or approved equal.

2.03 MATERIALS

A. Aluminum: Alloy and 6063-T6 temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B209/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.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS 12; 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 A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

C. Thermal Break:
1. Pour and debridge thermal barrier shall be a two part chemically curing polyurethane casting resin poured in place. specified. Thermal barrier extrusion pour cavities shall be mechanically lanced or azo-braded to secure the thermal break material.
2. Continuous extruded polyamide with 25% glass fiber reinforcing, mechanically crimped into cross-knurled cavities at vertical filler extrusion

2.04 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken at Exterior Framing and Non-thermally broken at Interior Framing.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Storefront:
   1. Sub-sill shall be anchored to continuous interior aluminum angle. Anchorage down through the bottom (Horizontal Portion) of the sub-sill is not acceptable. Interior angle size and attachment to storefront system and to perimeter framing to be engineered and installed as part of this work. Show angle and anchors on shop drawings. Stamped and signed by Professional Engineer.
   2. Seal joints in sub-sill with silicone tape, including transverse joints, mitered corners, end dams and so on. Reliance on metal splice plates and/or sealant is unacceptable.
   3. Provide reinforcing of mullion framing, as necessary, to meet design loads per project specific structural calculations.

H. Aluminum Frames for Doors, Sidelights, or Transoms: Extruded aluminum, non-thermally broken hollow or C-shaped sections; no steel components.
   1. Frame Depth: To fit wall thicknesses as indicated on drawings.
   2. Profiles:
      a. Typical frames:
         1) Double rabbets, see Door Schedule for size.
         2) .5" stop.
      b. Single rabbetted frames, see Door Schedule.
         1) Stopless frame with custom aluminum tube stop each side, as shown on detail.
         2) Custom aluminum tube stop sized to accommodate magnetic lock and finished to match frame. See details and section 08 71 00.
         3) Exposed top of frame:
            (a) Cover exposed end with aluminum cap with eased edges, finish to match.
            (b) Cover exposed end of aluminum tube stop with LDPE plastic cap with eased edges.
               (1) Color to match frame.
               (2) Top of plastic cap to be flush with aluminum cap.
               (3) Permanently adhere cap to tube.
         4) Contractor's option: fabricate single rabbetted frame to match profile on detail and accomodate magnetic lock.
            (a) Cap frame to match.

2.05 GLAZING SYSTEMS

A. Glazing: As specified in Section 08 81 00 - Glazing.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard silicone type.

2.06 SILICONE SEALANTS

A. Provide sealed end caps at tops of vertical mullions, thermally-broken caulk-stops at jamb and head conditions, and other accessories needed.

B. See Section 07 92 00 for glazing sealants.

C. Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT. Color: Submit full range for Architect's selection.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 791, 795, 995, or 999-A.

b. GE Advanced Materials - Silicones; SilGlaze II SCS2800, SilPruf NB SCS900,0 SilPruf SCS2000, and UltraPruf II SCS2900.
c. Pecora Corporation; 864.
d. Tremco Incorporated; Spectrem 2 or Spectrem 3.

2. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.07 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods. No thermal break.
2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide non-removable glazing stops on outside of door.

2.08 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in Section 08 71 00 - Door Hardware.
1. Coordinate Keying with Hardware providers and Keying Schedule.

2.09 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 92 00 - Joint Sealants.

B. Bituminous Paint: Cold applied asphalt mastic, containing no asbestos fibers.

C. Flashing: See Section 07 62 00.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using screw-spline system.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. Typical: Dark Bronze Anodic Finish: AAMA 611, AA-M12C22A, Class 1, 0.018 mm or thicker.

PART 3 EXECUTION

3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by 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.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior. Install sponge baffles at weep holes.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 - Joint Sealants to produce weather-tight installation. Provide additional sealant as detailed.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 08 81 00 - Glazing.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weather-tight enclosure and tight fit at weather stripping.
2. 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. Set threshold in full sealant bed as specified in Section 07 92 00 - Joint Sealants to produce weather-tight installation. See 08 71 00.

H. Install perimeter joint sealants as specified in Section 07 92 00 - Joint Sealants to produce weather-tight installation.
1. Minimum joint size: 3/8"

3.03 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
1. ASTM E1105, ASTM E283/E283M and AAMA 501.2 Water/Air testing. Contractor to assist with testing by providing safe access, water, power, chamber materials and personnel to perform the tests. If failure occurs, provide additional test assistance as needed to pa ss test at no additional cost.
2. See Structural drawings for required wind loads and pressures to be tested.
3. No increase in allowable rate of air infiltration or increase in the volume of water leakage, nor any decrease in the specified test pressures is permitted. Test according to AAMA 503. Test first frames installed.
4. Coordinate testing with the requirements of Section 01 91 13.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 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 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION

SECTION 08 44 13
GLAZED ALUMINUM CURTAINWALL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum curtain wall framing.

B. Anchors, brackets, attachments, and cap flashing as indicated.

1.02 RELATED STANDARDS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 45 00 - Precast Architectural Concrete.

F. Section 04 20 00 - Unit Masonry Assemblies.

G. Section 05 12 00 - Structural Steel Framing.

H. Section 05 21 00 - Steel Joist Framing.

I. Section 05 31 00 - Steel Decking.

J. Section 05 40 00 - Cold-Formed Metal Framing.

K. Section 06 10 00 - Rough Carpentry.

L. Section 07 21 00 - Thermal Insulation.

M. Section 07 27 26 - Fluid Applied Membrane Air Barrier.

N. Section 07 62 00 - Sheet Metal Flashing and Trim.

O. Section 07 84 00 - Firestopping.

P. Section 07 92 00 - Joint Sealants.

Q. Section 08 08 00 - Commissioning of Openings.

R. Section 08 71 00 - Door Hardware.

S. Section 08 81 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

C. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. AAMA CWM - Curtain Wall Manual; 2019.

F. ADAAG - Americans With Disabilities Act Accessibility Guidelines; 2010.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A446/A446M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality; Current edition.

I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

O. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 PERFORMANCE

A. Prepare design drawings and calculations under seal of a Professional Structural Engineer licensed in the state/province of the project and fully experienced in the design of curtainwall framing systems.

B. Full design and detail structural connections of curtainwall system to building. Consult with building structural engineer before transferring any loads back to building structure.

C. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 F deg. without causing detrimental effects to system or components.

D. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind to the design pressures as measured in accordance with ASTM E330/E330M.
   1. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category, Exposure Category, and Internal Pressure Coefficient indicated on Structural Drawings.

E. Member Deflection: for spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of L/175 of span or ¾ inch, whichever is less and with full recovery of glazing materials.

F. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.

G. Air Infiltration: Limit air infiltration through curtainwall framing assembly to 0.06 cfm/sq ft at a static air pressure differential of 6.24 psf, when tested in accordance with ASTM E283/E283M.

H. Water Resistance (dynamic): System shall demonstrate no water penetration at a test pressure of 15.00 psf as measured in accordance with ASTM E331.

I. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.

J. Condensation Resistance Factor: CRF of 55 for Glass and 66 at frame or greater when tested in according to AAMA 1503.

1.05 SUBMITTALS

A. Material and Equipment Submittals:
   1. Calculations: Submit design calculations with engineer's stamp showing assembly meets requirements of Part 1.04 above.

B. Shop Drawings: Prepared by curtainwall framing manufacturer; including elevations, system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required. Provide large-scale details of entrance doors detailed hardware schedule.
   1. Samples: Submit samples of anodized aluminum finish for final color approval.

2. Installation Data: Special installation requirements.

C. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

D. Mock-Ups: Provide mock-up of sufficient size to show all components of the system to be installed.
1. See drawings for information on required mock-ups.
2. Coordinate work on mock-up with work of other sections.

E. Closeout Submittals:
1. Warranty: As specified in this Section.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Perform Work in accordance with AAMA CWM - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual. Maintain one copy on site.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years' experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by manufacturer.

E. Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Project.

F. Manufacturer Qualifications: Minimum of 5 years experience in manufacturing exterior sun control devices similar to those specified.

G. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of sun controls that are similar to those indicated for this project in material, design and extent.

1.07 PRE-INSTALLATION MEETING

A. Convene a pre-installation conference under provisions of Section 01 31 00 - Project Management and Coordination one-week prior to commencing work of this Section.
1. Attendance required of Contractor, system installer, and parties directly affecting work of this Section.
2. Review conditions of installation, installation procedures and coordination required with Related Work.
3. Coordinate Keying, Compatibility and appearance of visible hardware with hardware provider.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, store, and protect system components under provisions of Section 01 60 00-Material and Equipment.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.

e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: 5 years from date of Substantial Completion.
3. Sub-Contractor 2 year warranty for all work.

PART 2 PRODUCTS

2.01 CURTAINWALL FRAMING SYSTEMS

A. Curtainwall Framing: Aluminum extrusions conforming to ASTM B221, alloy 6060-T5; thermally improved, exterior glazed pressure plate type curtainwall system framing system to accept 1" insulated glazing; 2-1/2" wide face dimension x depth as indicated on Drawings. Must accept primary seal at shoulder of curtain wall mullion, directly behind glazing. See details.

B. Acceptable Manufacturers and Products:
1. CMI Architectural Products, Inc., 6600 Wall
2. EFCO Corporation, Series 403 T.
3. Kawneer Company, Inc., 1600 Wall System 1.
4. Midland Glass Company 400 Wall / 200 Wall.
5. Tubelite 200 Series 2” Sightline to match Storefront.
6. Oldcastle Building Envelope. Reliance LT Curtain Wall.
7. YKK AP; YCW 750 OG.

2.02 ALUMINUM ENTRANCES

A. Aluminum Entrances: As specified in Section 08 41 13 - Aluminum Entrances and Storefronts.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221/ASTM B221M.

B. Sheet Aluminum: ASTM B209/B209M.

C. Sheet Steel: ASTM A446/A446M.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections.

E. Fasteners: Stainless steel.

F. Flashings: .063 inch thick aluminum finish to match curtain wall mullion sections where exposed, secured with concealed fastening method.

2.04 FINISHES

A. Dark Bronze Finish: AAMA 611, AA-M12C22A, Class I, 0.018 mm or thicker.

2.05 GLASS AND GLAZING MATERIALS

A. Glazing Materials: As specified in Section 08 81 00 - Glazing.

2.06 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in Section 07 92 00 - Joint Sealers.

2.07 ACCESSORIES

A. Fasteners: Aluminum or non-magnetic stainless steel, warranted by manufacturer to be non-corrosive and compatible with aluminum components. Avoid use of exposed fasteners. Provide matching Phillips flat-head screws for exposed fasteners.

B. Glazing Accessories: Manufacturer's standard silicone glazing gaskets and setting blocks designed specifically for specified system.

C. Cap/Sill Flashings: Aluminum, anodized finish to match curtainwall mullion sections where exposed, secured with concealed fastening method.

2.08 FABRICATION

A. Fabricate curtainwall frames allowing for minimum clearances and shim spacing around perimeter of assembly. Shop fabricate frame components where possible.

B. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Fabricate anchorage items.

E. Arrange fasteners, attachments, and jointing to ensure concealment from view.

F. Prepare components with required internal reinforcement for door hardware.

G. Finish, fabricate and shop assemble curtainwall under the responsibility of single manufacturer.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install curtainwall frames in accordance with manufacturer's instructions, or more stringent requirements indicated.

B. Use anchorage devices to securely attach frame assembly to structure.

C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work. Install aluminum infill panels in curtainwall framing similar to glazing.

D. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install glass in accordance with Section 08 81 00, using dry method of glazing.

G. Install perimeter sealant and backing materials, in accordance with Section 07 92 00.

H. Install hardware in accordance with Section 08 71 00 - Door Hardware.

I. Adjust operating hardware. All door operation to comply with requirements of ADAAG.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
   1. ASTM E1105, ASTM E283/E283M and AAMA 501.2 Water/Air testing. Contractor to assist with testing by providing safe access, water, power, chamber materials and personnel to perform the tests. If failure occurs, provide additional test assistance as needed to pa ss test at no additional cost.
   2. See Structural drawings for required wind loads and pressures to be tested.
   3. No increase in allowable rate of air infiltration or increase in the volume of water leakage, nor any decrease in the specified test pressures is permitted. Test according to AAMA 503. Test first frames installed.
   4. Coordinate testing with the requirements of Section 01 91 13.

B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.04 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
      b. Sliding doors.
      c. Folding doors.
      d. Other doors to the extent indicated.
   2. Cylinders for doors specified in other Sections.
   3. Electrified door hardware.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 07 92 00 - Joint Sealants.

E. Section 08 11 13 - Hollow Metal Doors and Frames.

F. Section 08 14 16 - Flush Wood Doors.

G. Section 08 31 13 - Access Doors and Frames.

H. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

I. Section 08 42 45 - Sliding Aluminum Doors.

J. Section 08 43 13 - Fire Rated Aluminum Frames Entrances and Storefronts.

1.03 REFERENCE STANDARDS

A. ADA Standards; Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI; American National Standards Institute. Requirements as specified below.

C. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100).

D. BHMA Builders Hardware Manufacturer's Association. Requirements as specified below.

E. DHI WDHS.3 Door and Hardware Institute; Recommended Locations for Architectural Hardware for Flush Wood.

F. NAAMM HMMA 831 National Association of Architectural Metals Manufacturers. Hardware Locations for Hollow Metal Doors and Frames.

G. NECA; National Electrical Code. Requirements as specified below.

H. NFPA; National Fire Protection Association. Requirements as specified below.

I. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. 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.
   2. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
   3. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

B. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

C. Pre-Installation Meeting: Conduct meeting at Project site to comply with requirements in Section 01 31 00 - Project Management and Coordination. Review methods and procedures related to electrified door hardware including the following:
   1. Inspect and discuss electrical roughing-in and other preparatory Work performed by other trades.
   2. Review sequence of operation for each type of electrified door hardware.
   3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review required testing, inspecting, and certifying procedures.
   5. Record minutes of meeting, indicating when it was held and who was in attendance, and submit to Owner, Architect, and hardware supplier.

D. Keying Meeting: Conduct meeting at Project site to comply with requirements in Section 01310 - Project Management and Coordination. Incorporate keying meeting decisions into final keying schedule after reviewing door hardware keying system.

1.05 ACTION SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: Power, signal, and control wiring. Verify voltage with electrical engineer. Include the following:
      a. System schematic.
      b. Point-to-point wiring diagram indicating detailed interface between electrified door hardware, fire alarm, and security systems. Clarify between manufacturer-installed and field-installed wiring.
      c. Riser diagram, including electrified components, gage of wire, and wire run.
      d. Elevation of each door.
   2. Detail interface between electrified door hardware and fire alarm, access control, security and building control, system.
   3. Operation Narrative: Describe operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of final door hardware sets.
   1. Sample Size: Submit minimum 2-by-4-inch (51-by-102-mm) plate Samples of each type of finish required, except primed finish.
   2. 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 Work, within limitations of keying requirements.

D. Other Action Submittals:
   1. Door Hardware Sets: Prepared by or under supervision of, and signed by, Architectural Hardware Consultant (AHC), detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate final door hardware sets with doors, frames, and related Work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Hardware schedules submitted without AHC’s signature will be rejected without review.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
   1) Use same scheduling sequence, format, and door numbers indicated in Contract Documents.
c. Content: Include the following information:
   1) Identification number, location, hand, fire rating, and material of each door and frame.
   2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
   3) Complete designations of every item required for each door or opening including name and manufacturer.
   4) Fastenings and other pertinent information.
   5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   6) Explanation of abbreviations, symbols, and codes contained in schedule.
   7) Mounting locations for door hardware.
   8) Door and frame sizes and materials.
   9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      (a) Sequence of Operation: Include description of component functions that occur in the following situations: Authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
   10) List of related door devices specified in other Sections for each door and frame.
d. Submittal Sequence: Submit final door hardware sets at earliest possible date, particularly where approval of door hardware sets must precede fabrication of other Work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other Work affected by door hardware, and other information essential to coordinated review of door hardware sets.

2. Keying Schedule: Prepared by or under supervision of Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
   a. Submit 1 copy to Architect for information only.

E. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure design intent of system/assembly is understood and can be reviewed together.
   1. Section 08 11 13 - Hollow Metal Doors and Frames.
   2. Section 08 11 16 - Aluminum Doors and Frames.
   3. Section 08 14 16 - Flush Wood Doors.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.
   1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
   1. Operating and maintenance manuals: Submit 3 sets containing the following:
      a. Maintenance instructions and warranty information for each item of hardware.

b. Catalog pages for each product.
c. Contact information for supplier of hardware and local representatives of each product manufacturer.
d. Parts list for each product.
e. Copy of final hardware schedule.
f. Copy of final wiring diagrams.
g. Copy of final keying schedule.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete units of door hardware listed in group 300.0, at project completion, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: Firm with 3 years experience in installation of commercial hardware similar to that required for this Project, and an employer of workers trained and approved by product manufacturers and 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. Installer's responsibilities include supplying and installing door hardware and providing qualified Architectural Hardware Consultant (AHC) available during course of Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   2. Successfully completed not less than 5 comparable scale projects.
   3. Warehousing Facilities: In Project's vicinity.
   4. Scheduling Responsibility: Preparation of door hardware and keying schedules.
   5. 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.

B. Supplier Qualifications: Recognized commercial hardware supplier that maintains and operates an office and stocking warehouse in Project area for at least 2 years and can document experience with projects of similar type and scale.
   1. For door hardware, an Architectural Hardware Consultant (AHC).
   2. Consulting services include overseeing scheduling, coordinating of hardware, establishing keying schedule, and being available during construction to consult with Contractor, Architect, and Owner about mechanical and electrical door hardware specified.

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
   1. Provide electrified door hardware from 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.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in 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 per NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed per NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm per square foot (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3 inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 pound-force (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with a force of not more than 5 pound-force (22.2 N).
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 pound-force (22.2 N) applied perpendicular to door.
      b. Sliding or Folding Doors: 5 pound-force (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 70 degrees, door will take at least 3 seconds to move to a point 3 inches (76 mm) from the latch, measured to leading edge of door.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic 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.

D. Deliver permanent keys and cores to Owner by registered mail or overnight package service.

1.11 WARRANTY

A. Warrant materials and workmanship against defects including coverage for operation of specified hardware, after completion and final acceptance of Work.
   1. Repair defects from faulty materials or workmanship developed during guarantee period, or replace with new materials, at no expense to Owner.
   2. Replace shortages and incorrect items with correct materials at no additional cost to Owner.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in attached Door Hardware Schedule Article and on Drawings to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers'
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 Door Hardware Schedule Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 Door Hardware Schedule Article.
   2. References to BHMA Designations: Where products are not specified by name, provide products complying with BHMA designations and requirements for description, quality, and function.

2.02 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.]
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Bommer Industries, Inc.

b. Hager Companies.
c. HB Ives (Div of Ingersoll Rand)
d. McKinney Products Company; an ASSA ABLOY Group company.
e. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."

C. Hinge Sizes: Provide the following hinges in widths sufficient to minimally clear trim.
1. Thickness Size
a. 5 inch (127 mm) by 5 inch (127 mm)
b. 4-1/2 inch (114 mm) by 4-1/2 inch (114 mm)
c. 3-1/3 inch (89 mm) by 3-1/2 inch (89 mm)

D. Furnish butt hinges for each door leaf as follows:
1. 1 pair per leaf for openings through 60 inches (1524 mm) high.
2. 1 additional hinge per leaf for each additional 30 inches (762 mm) in height or fractions thereof.
3. 1 additional hinge for doors 3’-4” wide to 4’-0” wide.
4. 1 additional hinge for exterior and vestibule doors.

E. Applications:
1. Exterior out swinging doors: Type 4 x NRP.
2. Exterior in swinging doors and vestibule doors: Type 3.
3. Interior doors over 36 inches (914 mm) in width: Type 3.
4. Interior doors 36 inches (914 mm) or less: Type 1.
5. Exterior and reversed beveled interior lockable doors: Non-removable loose pin (NRP) hinges.

F. Acceptable Manufacturers and Products:

Type	Bommer	Hager	Ives	McKinney	Stanley
Type 1	BB5000	BB1279	5BB1	TA2714	FBB179
Type 2	BB5002	BB1191	5BB1	TA2314	FBB191
Type 3	BB5004	BB1168	5BB1HW	T4B3786	FBB168
Type 4	BB5006	BB1199	5BB1HW	T4B3386	FBB199

2.03 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; 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.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

Type	McKinney	Hager	Ives	Stanley	Select	Pemko
SS Pin & Barrel	MCK-FM300	790-900	700	651	SL300	
Continuous, Gear Type	MCK-12HD	780-112HD	112HD	661HD	SL-11HD	
Continuous,Safety						_FM_SF

C. Prep hinges for electric power transfers and automatic door bottoms where specified.

D. Provide 1 of 2 models above of continuous hinges as appropriate for type, inset, and thickness of door where specified. Coordinate hinge types with door supplier.

2.04 ELECTRIC POWER TRANSFER

A. Electrified Functions for Hinges: Comply with the following:
1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
a. Securitron Corporation; an ASSA ABLOY Group company: CEPT-10.
b. Von Duprin; an Ingersoll-Rand Company: EPT-2/EPT-10.

2.05 MECHANICAL LOCKS AND LATCHES

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 inch (70 mm), with deadlocking feature unless otherwise indicated.

D. 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; finished to match lock or latch.
   1. Flat-Lip Strikes: For locks with 3-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.

E. Bored Locks – Heavy Duty Type: BHMA A156.2; Grade 1; Series 4000.
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Base Bid: Schlage, No Substitutions
      b. Alternate pricing will be accepted from the following manufacturers. Owner to accept or decline alternate pricing.
         1) Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
         2) SARGENT Manufacturing Company; an ASSA ABLOY Group company.
         3) Yale Commercial Locks; an ASSA ABLOY Group company.
         4) Falcon Locks; an Allegion Company.
   2. Where listed, provide electrified locks that comply with above requirements and that incorporate self-contained integral continuous duty solenoid. Provide 24V, either AC or DC as required in Fail-Safe or Fail-Secure function as listed in hardware sets. Provide electrified locks from same manufacturer as mechanical locks.
   3. Acceptable Manufacturers and Products:

	Corbin-Russwin	Sargent	Schlage	Yale	Falcon
Lock	CL3300	FW-10-Line	L-ND	5400LN	T-Series
Trim	NZD	LL	RHO	AU	D - Dane

F. Mortise Locks:
   1. BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Base Bid: Schlage, No Substitutions.
      b. Alternate pricing will be accepted from the following manufacturers. Owner to accept or decline alternate pricing.
         1) Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
         2) SARGENT Manufacturing Company; an ASSA ABLOY Group company.
         3) Yale Commercial Locks; an ASSA ABLOY Group company.
         4) Falcon Locks; an Allegion company.
   3. Provide locks with reversible handing of lock without disassembly of lock.
   4. Where listed, provide electrified locks that comply with above requirements and that incorporate self-contained integral continuous duty solenoid. Provide 24V, either AC or DC as required in Fail-Safe or Fail-Secure function as listed in hardware sets. Provide electrified locks from same manufacturer as mechanical locks.

	Corbin-Russwin	Sargent	Schlage	Yale	Falcon
Lock	ML2000	8200	L-9000	8800FL	MA-Series
Trim-sect	NSA	LNL	06A	AUR	DG

2.06 STAND ALONE ACCESS CONTROL LOCKS

A. Provide security-locking system that is stand alone battery operated ANSI/BHMA Grade One locks. All locks shall have an interchangeable core cylinder bypass. All levers shall match mechanical locks and trim. Provide units with a weather seal when used in areas of moisture and high humidity. All readers shall be equipped with non-volatile memory. Provide locks capable of minimum of 100 user capacity.
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Alarm Lock DL2700
      b. Corbin-Russwin CL33800 series.
      c. Sargent 10G77Lk
      d. Schlage CO-100 Series
      e. Yale NTB613

2.07 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; Grade 1; minimum 3/4 inch (19 mm) throw; designed for use in metal doors and mortised into door edge for all doors. Coordinate with Wood Door Manufacturers.
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Door Controls International, Inc.
      b. Hager Companies.
      c. IVES Hardware; an Ingersoll-Rand company.
      d. McKinney Products Company; an ASSA ABLOY Group company.
      e. Trimco.

2.08 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; Grade 1; minimum 3/4 inch (19 mm) throw; designed for use in metal doors and mortised into door edge for all doors. Coordinate with Wood Door Manufacturers.
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Door Controls International, Inc.
      b. Hager Companies.
      c. IVES Hardware; an Ingersoll-Rand company.
      d. McKinney Products Company; an ASSA ABLOY Group company.
      e. Rockwood Architectural Hardware; an ASSA ABLOY Group company.
      f. Trimco.

	DCI	Hager	Ives	McKinney	Rockwood	Trimco
Man-Metal Door	780F	282D	FB458	FB01M	555	3917
Auto-Metal Door	842	292D	FB31P	FB06M	1842	3810
Dust Proof Strike	82	280X	DP2	DPS3	570	3911

2.09 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3, Grade 1.
   1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
      a. Base Bid: Von Duprin, No Substitutions.
      b. Alternate pricing will be accepted from the following manufacturers. Owner to accept or decline alternate pricing.
         1) Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
         2) SARGENT Manufacturing Company; an ASSA ABLOY Group company.
         3) Yale Commercial Locks; an ASSA ABLOY Group company.
         4) Falcon Exit Devices; an Allegion Company
   2. Provide exit devices by single manufacturer.

3. Provide vandal resistant outside trim to discourage abuse when door is locked. Provide trim with lever design to match locks.
4. Provide device where noted with a photoluminescent coating which will produce visible EXIT signage in darkness or low lit areas similar to Yale “LUM”.
5. Provide cylinder dogging on non-rated devices.
6. Provide devices with a heavy duty flush end cap.
7. Removable Mullions: Keyed.
8. When Electrified functions are specified, provide manufacturer’s recommended power supply that is filtered and regulated; and listed and labeled for use with fire alarm systems, with power sufficient to operate electrified function specified.

	Corbin-Russwin	Von Duprin	Yale	Sargent	Falcon
Wide Stile	ED5000S-M110	70 Series	7100-ECK Series	GL-43-80 Series	25-Series
Active Trim	900 Series	996L	600 Series	740ET	510L

B. Value Series Alarmed Exits only as specified in hardware groups.
1. Exit Device and Auxiliary Items: BHMA A156.3, Grade 1.
   a. Manufacturers: Subject to compliance with requirements, provide specified products by the following manufacturer:
      1) Detex.
   b. Provide exit devices by single manufacturer.
   c. Provide devices with weatherized exit alarm that allows cylinder dogging. Touchpad shall be RED with the following silk screened on the face “Emergency Exit Only Alarm will Sound”.
   d. Removable Mullions: When used in conjunction with valued series alarmed exits, provide Yale M300 aluminum mullion including mullion stabilizer kit.
      1) Wide Stile: Detex V40xEBxW

2.10 ELECTRIC STRIKES

A. Comply with ANSI/BHMA A156.5 requirements for Grade 1.

B. Provide electric strikes UL listed for fire rated doors and frames where required.

C. Provide corrosion-resistant case and working parts

D. Provide 4 7/8 inch face plates for use with mortise cylindrical locks.

E. Provide fail secure strikes (locked when power is off) for labeled doors.

F. Provide electric strikes that comply with above requirements with plug connector. Provide wiring harness as listed below. Provide 24VDC with function as listed in hardware sets.

G. Acceptable Manufacturers and Products:

	Folger-Adam	HES	Von Duprin
Cylindrical Lock	700 Series	1006 Series	6211

2.11 MAGNETIC LOCKS

A. Acceptable Manufacturers and respective catalog numbers:

	Schlage Electronics
Shear Lock	320M Series

B. Provide magnetic locks as specified, complete with mounting brackets and fasteners appropriate to the application. Shear Locks shall have a minimum of 500 lbs holding force.

C. Provide magnetic locks with integral magnetic bond sensor, time delay (1-90 Seconds) for re-locking.

D. Provide regulated and filtered power supplies for magnetic locks by the same manufacturer.

2.12 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
1. Manufacturer: Same manufacturer as for locking devices.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Base Bid: Schlage, No Substitutions.
   b. Alternate pricing will be accepted from the following manufacturers. Owner to accept of decline alternate pricing.
      1) Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      2) SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      3) Yale Commercial Locks; an ASSA ABLOY Group company.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are 6-Pin Utility Patented interchangeable; face finished to match lockset.

C. Construction Cores: Provide temporary keyed construction cores and keys for all doors during the construction period. Construction control and operating keys and cores shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system. .

2.13 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Base Bid: Schlage, No Substitutions.
   2. Alternate pricing will be accepted from the following manufacturers. Owner to accept or decline alternate pricing.
   3. Utility Patented Keyway Acceptable Manufacturers and Products:

	Corbin-Russwin	Sargent	Schlage	Yale
Keyway	Pyramid	Signature	Classic Primus	KeyMark

B. Keys: Nickel silver factory-cut keys furnished with large bow.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE." [Information to be furnished by Owner.]
   2. Quantity: provide the following:
      a. Change Keys: See Door Schedule & Keying Legend on Drawings
      b. Control Keys: 2 each.
      c. Extra Key Blanks: 50 each.
      d. Master Keys: See Door Schedule & Keying Legend on Drawings.
      e. Construction Control Keys: 2 each.
      f. Construction Keys: 15 each.
   3. Ship permanent keys, cores, master keys, change keys, and additional key blanks, permanent control keys, and bitting list indicating bitting generated for this Project, directly to Owner, via registered mail. Shipment shall be complete, with keys enveloped in sets and tagged with key set numbers (with proper code numbers and factory file or folio number). Do not pack permanent keys and cores with locks. If permanent keys, cores, or both are sent anywhere other than previously stated, replace at no additional cost to Owner.
      a. Forward Owner's Key System Registration Certificates, which shall accompany each procurement during construction period, to hardware supplier.

2.14 KEY CONTROL SYSTEM

A. Key Control Cabinet: Provide BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of number of locks.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Key Boxes and Cabinets.
      b. GE Security, Inc.

c. HPC, Inc.
d. Lund Equipment Co., Inc.
e. MMF Industries.
f. Tri Palm International.

2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.15 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: 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 and with internal override.

1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
   a. Door Controls International (DCI).
   b. Hager Companies.
   c. Ives Hardware; an Ingersoll-Rand Company.
   d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
   e. Trimco.

	DCI	Hager	Ives	Rockwood	Trimco
Coordinator	600 Series	297D	COR	1600	3094

2.16 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4 Grade 1; 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 recommendations 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.

1. Manufacturers: Subject to compliance with requirements, provide specified products by one of the following:
   a. Base Bid: LCN, No Substitutions
   b. Alternate pricing will be accepted from the following manufacturers. Owner to accept or decline alternate pricing.
      1) Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
      2) Falcon Closers, an Allegion Company.
      3) SARGENT Manufacturing Company; an ASSA ABLOY Group company.
2. Fully adjustable type, with complete spring power adjustment, sizes 1 through 6.
3. Provide closers with swing, latch, and back check features.
4. Provide parallel rigid arm for closers mounted on push side of opening.
5. Coordinate with door supplier to provide proper blocking for surface mounting. Use of through-bolts is not acceptable.
6. Where closers are indicated to be closer/stops provide heavy-duty arms with means of positive stop. For closer/holders, provide heavy-duty units with additional built-in mechanical holder assembly. Manually select holder to off/on position.
7. Provide meeting requirements to physically handicapped, provide units complying with ANSI/ICC A117.1 provisions for door opening force closing force.
8. Install closers using only manufacturer-furnished template machine screws for metal doors and manufacturer -furnished wood screws for wood doors.
   a. Use of self-drilling or self-tapping fasteners is not allowed.
9. Accessories: Mounting brackets, drop plates, special shoes required by door and frames conditions.
10. Acceptable Products: Subject to compliance with requirements, provide one of the following:

	Corbin-Russwin	LCN	Sargent	Falcon
Surface Closer	DC800A10/ DC8000A3	4010/4110	281/281P-10	SC70 Series

2.17 AUTOMATIC DOOR OPERATORS

A. Acceptable manufacturers and respective catalog numbers:

	Horton	LCN	Norton	Stanley
Electro-Hydraulic Operator	4000LE	4640	5900	Magic Force

B. Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.

C. The closing action shall be controlled by modern type cast iron door closer cylinder filled with a flat viscosity fluid, stable from +120F to -30F that would require no seasonal adjustments. The closer shall have field adjustable spring power; have two independent closing speed adjustment valves, and hydraulic back-check.

D. Full closing force shall be provided when the power or assist cycle ends.

E. All power operator systems shall include the following features and functions:
   1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
   2. The operator will be designed with an electronically controlled mechanical clutching mechanism to prevent damage to the operator if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
   3. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI/BHMA Standard A156.18.
   4. UL listed for use on labeled doors.
   5. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
   6. The power operator shall incorporate microprocessor controlled digital controls including: factory default memory settings, on-board diagnostics, non-volital memory, and intergrated delay and relay for controlling door release devices.
   7. Provisions in the control box or module shall provide control {inputs and outputs) for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, and stop side sensors.
   8. Wall mounted actuators shall consist of a 4-1/2 inch diameter stainless steel touch plate with a blue filled handicapped symbol. Switches shall be weather resistant and mount on a single gang electrical box furnished by Division 16.

F. All electrically powered operators shall include the following features or functions:
   1. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.
   2. Easily accessible main power and maintain hold open switches will be provided on the operator.
   3. An electronically controlled clutch to provide adjustable opening force.
   4. A microprocessor to control all motor and clutch functions.
   5. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.
   6. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.
   7. If electrical failure occurs, the unit shall operate as a standard door closer.

G. Activation and Safety Devices.
   1. General: Provide activation devices per BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

2. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message and weather resistant gasket for exterior openings.
   a. Configuration: Round push plate with 4-1/2-inch (100-by-100-mm) with surface mount box.
      1) Mounting: Surface mounted as indicated on Drawings.
   b. Push-Plate Material: Stainless steel.
   c. Message: International symbol of accessibility and "Push to Open."
   d. Products similar to Wikk N4RS x4R-3
3. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

H. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.18 MECHANICAL STOPS AND HOLDERS

A. Wall- Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal
1. Manufacturers: Where indicated in doors and hardware schedules, provide specified products from one of the following:
   a. Door Controls International, Inc.
   b. Hager Companies.
   c. IVES Hardware; an Ingersoll-Rand company.
   d. McKinney; an ASSA ABLOY Group Company
   e. Rockwood Manufacturing Company; an ASSA ABLOY Group Company.
   f. Trimco.
2. Install surface-mounted stops and holders using only manufacturer supplied template machine screws for metal doors and manufacturer supplied wood screws for wood doors. Use of self-drilling or self-tapping fasteners is not allowed.
3. Coordinate with door supplier to provide proper blocking for surface mounting. Use of through-bolts is not acceptable.

B. Wall Stops:

	DCI	Hager	Ives	Rockwood	Trimco
Convex	3210	236W	WS406CVX	407	1270CX
Concave	3211	232W	WS406CCV	410	1270CV
Extended	3260X	255W	WS11	518	1208

2.19 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted or floor-mounted electromagnetic units with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.
1. Acceptable Products: Subject to compliance with requirements, provide one of the following:

	LCN	Rixson	Sargent
Flush Mount	SEM1900	FM998	1561

2. UL listed, triple voltage, field-selectable units. Provide extension pieces as required to meet wall conditions.

2.20 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.
1. Acceptable Products: Subject to compliance with requirements, provide one of the following:

Type	Glynn-Johnson	Rixson	Sargent
Heavy Duty Concealed	GJ-100	6-Series	690
Heavy Duty Surface	GJ-90	9-Series	590
Standard Duty Surface	GJ-450	10-Series	1540

2. Provide overhead stop for doors that are capable of swinging more than 145 degrees before striking wall and where door strikes fixed object such as sink, cabinet, and similar obstructions.

2.21 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested per ASTM E283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Basis of Design Product: Subject to compliance with requirements, provide MCKS88 Silicone Seal by McKinney Products Company or comparable product by one of the following:
      a. McKinney; an ASSA ABLOY Group company
      b. National Guard Products.
      c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      d. Reese Enterprises, Inc.
      e. Zero Manufacturing
   2. Coordinate with door manufacturer. Comply with UL10C for intumescent fire and smoke material.
   3. Provide smoke gasket at each labeled opening similar to McKinney MCKS88.

2.22 THRESHOLDS

A. Thresholds: BHMA A156.21; full saddle, fabricated to full width of opening indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. McKinney Products Company; an ASSA ABLOY Group company
      b. National Guard Products.
      c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      d. Reese Enterprises, Inc.

	McKinney	National Guard	Pemko	Reese	Zero
Thermal Break	MCK252x3FG	8425	252 x 3FG	S471A	625A

2.23 SWEEPS:

A. Hollow Metal and Wood Doors:
   1. Acceptable Manufacturers and Products:

	McKinney	National Guard	Pemko	Reese	Zero
Neoprene	MCK315-N	200N	315-N	323	39A
Rain Drip	MCK3452	C627	3452NB	354	8198A

B. Aluminum doors:
   1. Acceptable Manufacturers and Products:
      a. Adjustable Sweep: Special-Lite SL-301

2.24 WEATHERSTRIP

A. Acceptable Manufacturers and Products:

	McKinney	National Guard	Pemko	Reese	Zero
Polyprene	MCK303PK	135NA	303PK	815	8303

2.25 AUTOMATIC DOOR BOTTOMS

A. Provide units with a light-spring action which reduces the operating force to 3-5 pounds required for actuation.
   1. Pemko No. 4131 Series specified.
   2. Provide Pemko “RL” Sponge neoprene for units sealing against hard surfaces. Semi-mortised on non-rated openings.
   3. Provide Pemko “NBL” aluminum bar with nylon brush for units sealing over carpet. Semi-mortised on non-rated openings..
   4. Provide Pemko 420PKL for use in hollow metal and aluminum doors.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. McKinney Products Company; an ASSA ABLOY Group company

2. National Guard Products.
3. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
4. Reese Enterprises, Inc.
5. Zero Manufacturing

2.26 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050 inch (1.3 mm) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Burns Manufacturing Incorporated.
      b. Hager Companies.
      c. Hiawatha, Inc.
      d. Ives; an Ingersoll Rand Company
      e. McKinney Products Company; an ASSA ABLOY Group company
      f. Rockwood Manufacturing Company.
      g. Trimco.

B. Push Plates: Beveled edges (B4E).
   1. Size: 8 inch (203 mm) by 16 inch (406 mm). Provide 4 inch (102 mm) by 16 inch (406 mm) where 8 inch (103 mm) by 16 inch (406 mm) is not applicable due to door conditions.
   2. Acceptable Manufacturers and Products:

	Burns	Hager	Hiawatha	Ives	Rockwood	Trimco
8"x16"	57	30S	200K	8200	70F	1001-11
4"x16"	54	30S	200F	8200	70C	1001-3

C. Door Pulls: 1-1/4 inch (32 mm) round material, 18 inch (457 mm) screw centers, and 3-1/4 inch (83 mm) total projection with concealed screw mounting wherever through bolt attachment would leave an exposed screw. Provide reinforcement for hollow metal doors.

Burns	Hager	Hiawatha	McKinney	Rockwood	Trimco
M39G	23Q	HG122	OP9017	RM202	1191-5J

D. Offset Sauna and Steam Room Pulls: 1-1/8 inch round nylon material 14-3/16 inch x 6-7/8 inch.
   1. Acceptable Manufacturers and Products:
      a. HEWI 908.11.8xx Black BTB mount

E. Push/Pull Bars: 1-1/4 inch (32 mm) round material, pull with 12 inch (305 mm) screw centers, and 3-1/4 inch (83 mm) total projection
   1. Push bar 3 inches (76 mm) less than door width.
   2. Provide back-to-back mounting with top of pull and lock side of push bar. Provide decorative through-bolt at hinge stile and bottom of pull.
   3. Provide heavy-duty concealed fasteners with dual shoulder-mount set screws at mounting locations. Use of through-bolts is not acceptable.
   4. Coordinate with door supplier to provide proper blocking for mounting.

Burns	Hiawatha	McKinney	Rockwood	Trimco
M422xM396D	HG111xHG113	PB820	RM350	1745

F. Push Bars: 1-1/4 inch (32 mm) round material, 3 inches (76 mm) less than door width. Provide decorative through-bolt.

Burns	Hiawatha	McKinney	Rockwood	Trimco
M422	HG111xHG113	PB820-OP9017	RM251	1747-1

G. Kick Plates: Beveled edges (B4E).
   1. Widths: 2 inches (51 mm) less than door width.
   2. Height: 12 inches (254 mm) or 1/2 inch (13 mm) less than height of bottom rail, whichever is less.

H. Armor Plates: Beveled edges (B4E).
   1. Widths: 2 inches (51 mm) less than door width.
   2. Height: 42 inches (914 mm), and complying with door conditions.
   3. Notch for surface hardware.
   4. Where indicated for fire-rated doors, provide armor plates that are labeled and installed per listings.

I. Door Edge Guards: Stainless steel, 42 inches (1067 mm) high, 0.0478 inch (18 gage) thick unless otherwise specified in “Finishes” or in hardware groups. Notch for hinges.
   1. Surface-applied, for single acting doors. Delete if on hollow metal doors.

J. Latch Protection Plates: Stainless steel, 3 inches (76 mm) wide by 11 inches (279 mm) high, 0.0478 inch (18 gage) thick unless otherwise specified in “Finishes” or in hardware groups.

K. Trim Protection Bars: Stainless steel, 14 inch center-to-center with 3-1/4 inch projection, 3/8 inch thickness.
   1. McKinney: TPB05
   2. Rockwood: R115LBP

L. Hinge Finger guards: anodized aluminum with polyethylene sheet.
   1. National Guard Products: 2248DKB
   2. Color: Dark bronze/black.

2.27 AUXILIARY DOOR HARDWARE

A. Clothes Hooks:
   1. Acceptable products of the following manufacturers:

Don-Jo	Rockwood	Ives
302	796	582

B. Strip Curtain:
   1. Type: PVC
   2. Width: See Drawings.
   3. Height: 96” (VIF).
   4. Hardware: Galvanized Steel Hardware, Industrial Heavy Duty, Pre-Studded.
   5. Strip Width: 12” (66% overlap).
   6. Gauge: 0.12
   7. Color: Clear

2.28 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-rated 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 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, except 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 only means of securely attaching 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-head wood screws for wood doors.
   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. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.29 ELECTROMECHANICAL HARDWARE

A. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the supplier to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.

B. For each item of electrified hardware specified, provide standardized Molex plug connectors to accommodate up to twelve (12) wires. Molex plug connectors shall plug directly into through-door wiring harnesses, frame wiring harnesses to power supplies.
   1. If plug connectors are not available, coordinate installation and hook-up of hardware with a company that is licensed by the Local Electricity Board. Hinges shall be UL fire tested and listed for labeled doors up to and including Class “A”.

C. Where Electrified functions are specified, provide manufacturer’s recommended power supply that is filtered and regulated; and listed and labeled for use with fire alarm systems, with power sufficient to operate electrified function specified.

D. Electrical: Electrical boxes in walls, electrical service, conductors and final connections provided under Division 16:

E. Electro-Lynx Cables: McKinney Listed for use with Corbin Russwin, Sargent

2.30 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying 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 1/2 of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

Hardware Type	Finish
Exposed Metal Finishes:	BHMA 710/ 313AN Dark Bronze Anodized over nickel, brass or bronze.BHMA 643e, Dark Bronze powder coated over steel.BHMA 630/US32D, Satin Stainless Steel over Stainless Steel.
Hinges-Exterior	BHMA 710/ 313AN Dark Bronze Anodized
Hinges-Interior	BHMA 710/ 313AN Dark Bronze Anodized
Continuous Gear Hinges:	BHMA 710/ 313AN Dark Bronze Anodized
Continuous Pin and Barrel:	BHMA 710/ 313AN Dark Bronze Anodized

Locksets:	BHMA 710/ 313AN Dark Bronze Anodized
Closers:	695 / SP313 powder coat
Exit Devices:	BHMA 710/ 313AN Dark Bronze Anodized
Pushes, Pulls, Kick Plates:	BHMA 710/ 313AN Dark Bronze Anodized
Armor Plates:	BHMA 710/ 313AN Dark Bronze Anodized
Door Edge Guards:	BHMA 710/ 313AN Dark Bronze Anodized
Overhead Stops & Holders:	BHMA 710/ 313AN Dark Bronze Anodized
Door Stops:	BHMA 710/ 313AN Dark Bronze Anodized
Thresholds:	AL - Mill finish aluminum
Weatherstrip:	DKBRZ - Dark Bronze Anodized
Sweep Strips:	DKBRZ - Dark Bronze Anodized
Automatic Door Bottoms:	DKBRZ - Dark Bronze Anodized
Concealed:	DKBRZ - Dark Bronze Anodized
Semi Mortised:	DKBRZ - Dark Bronze Anodized
Rain Drips:	DKBRZ - Dark Bronze Anodized
Miscellaneous Items:	BHMA 710/ 313AN Dark Bronze Anodized

1. Hardware on aluminum doors shall match finish of doors and frames.

D. Provide locksets/latchsets, exit devices, push plates, pulls, push/pull plates, pushbar, armor plates and edge guards in BHMA 630 / US32D = Satin Stainless Steel, over stainless-steel base material with an imperceptible antimicrobial coating which stems the spread of bacteria and other microbes by attacking the cell walls, interrupting metabolism and preventing reproduction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: For surface applied door hardware, drill and tap doors and frames per ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
1. Hollow Metal Doors and Frames: ANSI/SDI A250.8.
2. Custom Hollow Metal Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "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 specified in Division 09 Sections. 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 according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than number recommended by manufacturer for application indicated or 1 hinge for every 30 inches (762 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 1 intermediate offset pivot per door and 1 additional intermediate offset pivot for every 30 inches (762 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.
2. Furnish permanent cores to Owner for installation.

F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
1. Configuration: Provide one manufacturer's power supply for each door opening, with power sufficient to operate locks.
   a. Verify voltage requirements with electrical engineer, or Architect.
2. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00 - Joint Sealants.

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.

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.

3.04 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage 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.

3.05 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, door will take at least 3 seconds to move to a point 3 inches (75 mm) from latch, measured to leading edge of door.

B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, schedule installer's architectural hardware consultant to examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 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.

3.07 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide 6 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 hardware operation. Provide parts and supplies same as those used in manufacture and installation of original products.

ATTACHMENT

4.01 HARDWARE GROUPS

HW SET: 001

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	BY DOOR SUPPLIER	

HW SET: 010

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PASSAGE SET	ND10S	SCH
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F75) PASSAGE LATCH. LATCH RETRACTED BY LEVER EITHER SIDE. BOTH LEVERS ALWAYS UNLOCKED.

HW SET: 012S

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50	SCH
1	EA	WALL STOP	WS406	IVE
1	SET	SEALS	188S	ZER
1	EA	COAT AND HAT HOOK	582	IVE

FUNCTION: ND50 (F82) ENTRANCE/OFFICE LOCK
PUSH-BUTTON LOCKING. PUSH-BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED WITH KEY OR BY TURNING INSIDE LEVER.

HW SET: 014

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	WALL STOP	WS406	IVE

FUNCTION: ND80 (F86) STOREROOM LOCK
OUTSIDE LEVER FIXED. ENTRANCE BY KEY ONLY. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 014K

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	EXIT X BLANK OUTSIDE	ND25D	SCH
2	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	FINGER GUARD	2248A-46"	NGP

FUNCTION: EXIT LATCH. NO OUTSIDE TRIM.
INSIDE LEVER ALWAYS UNLOCKED.
NOTE: PROVIDE CUSTOM TOP CAP FOR FRAME AT HINGE AND LATCH JAMB.

HW SET: 017D

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP	SCE
1	EA	OH STOP & HOLDER	90H	GLY

FUNCTION: WIRELESS KEYPAD LOCK. LATCH RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY PIN. INSIDE LEVER ALWAYS UNLOCKED FOR EGRESS. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 034

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	SURFACE CLOSER	4050 / 4050 EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: (F86) STOREROOM LOCK.
FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 034E

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	VON
1	EA	SURFACE CLOSER	4050 / 4050 EDA	LCN
1	EA	WALL STOP	WS406	IVE
1	EA	CARD READER	BY SECURITY SUPPLIER	
1	EA	DOOR POSITION SWITCH	BY SECURITY SUPPLIER	
1	EA	POWER SUPPLY	PS902 900-4R	SCE
1	EA	AXIS CONTROLLER	BY SECURITY SUPPLIER	AXS
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	
1	EA	REQUEST-TO-EXIT SWITCH	BY SECURITY SUPPLIER	

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED.
ELECTRIC STRIKE UNLOCKED BY CREDENTIAL READER / ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 036DKL

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	DBL CYL STORE LOCK	ND66 (VERIFY MOUNTING HEIGHT)	SCH
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	ALARM	EAX-500	DET
1	EA	FINGER GUARD	2248A-76"	NGP

FUNCTION: ND66 (F91) STORE LOCK
KEY IN EITHER LEVER LOCKS OR UNLOCKS BOTH LEVERS.
WHEN ARMED, OPENING DOOR SOUNDS ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 037

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP	SCE
1	EA	SURFACE CLOSER	4050 DEL / 4050 DEL EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE

FUNCTION: WIRELESS STANDALONE KEYPAD LOCK. LATCH RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY INTEGRAL KEYPAD. INSIDE LEVER ALWAYS UNLOCKED FOR EGRESS. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 037B

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP	SCE
1	EA	SURFACE CLOSER	4050 DEL SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: WIRELESS STANDALONE KEYPAD LOCK. LATCH RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY INTEGRAL KEYPAD. INSIDE LEVER ALWAYS UNLOCKED FOR EGRESS. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 037D

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP	SCE
1	EA	OH STOP	90S	GLY
1	EA	SURFACE CLOSER	4050 DEL / 4050 DEL EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: WIRELESS STANDALONE KEYPAD LOCK. LATCH RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY INTEGRAL KEYPAD. INSIDE LEVER ALWAYS UNLOCKED FOR EGRESS. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 037K

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP	SCE
1	EA	SURFACE CLOSER	4050 DEL / 4050 DEL EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	FINGER GUARD	2248A-76"	NGP

FUNCTION: WIRELESS STANDALONE KEYPAD LOCK. LATCH RETRACTED BY KEY. OUTSIDE LEVER UNLOCKED BY INTEGRAL KEYPAD. INSIDE LEVER ALWAYS UNLOCKED FOR EGRESS. UPON LOSS OF POWER, OUTSIDE LEVER REMAINS LOCKED.

HW SET: 044X

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CONT. HINGE	112HD	IVE
1	SET	FLUSH BOLT	CONSTANT LATCHING	IVE
1	EA	DUST PROOF STRIKE	DP2	IVE
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	COORDINATOR	COR X FL	IVE
2	EA	SURFACE CLOSER	4050 SHCUSH	LCN
2	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	WELDED OVERLAPPING ASTRAGAL	BY DOOR SUPPLIER	B/O
2	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655A	ZER

FUNCTION: (F07) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. AUXILIARY LATCH DEADLOCKS LATCH BOLT WHEN DOOR IS CLOSED.

HW SET: 051LX

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PANIC HARDWARE	LD-78-EO	VON
1	EA	EXIT ALARM KIT	78-ALK-RX	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655A	ZER

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 054B

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-78-L-NL	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 054X

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PANIC HARDWARE	LD-78-NL	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	WEATHERSTRIPPING	429	ZER
1	EA	DOOR SWEEP W/DRIP	8198	ZER
1	EA	THRESHOLD	8655A	ZER

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.

HW SET: 162HS

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED (STAINLESS STEEL)	IVE
2	EA	DOOR PULL, 3/4" RND	8102-8	IVE
2	EA	PUSH PLATE	8200 4" X 16"	IVE
2	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI	LCN
2	EA	KICK PLATE	8400 10"	IVE
2	EA	WALL STOP/HOLDER	WS40	IVE
1	EA	GASKETING	188S	ZER
1	SET	MEETING EDGE SEALS	557AA X 56AA	ZER
2	EA	DOOR BOTTOM	369A	ZER

FUNCTION: PUSH/PULL.

HW SET: 181

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	90 DEG OFFSET PULL	8190-0	IVE
1	EA	PUSH BAR	9100	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: PUSH/PULL.

HW SET: 181H

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	90 DEG OFFSET PULL	8190-0	IVE
1	EA	PUSH BAR	9100	IVE
1	EA	OH STOP & HOLDER	100HP	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: PUSH/PULL.

HW SET: 181KP

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	90 DEG OFFSET PULL	8190-0	IVE
1	EA	PUSH BAR	9100	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	DOOR BOTTOM	5VA	NGP
1	EA	FINGER GUARD	2248A-76"	NGP

FUNCTION: PUSH/PULL.

HW SET: 181MK

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	SAFETY HINGE	CFM-83LISF-HD	PEM
1	EA	SLIDING DOOR MAG	320M	SCE
1	EA	WALL STOP	WS406	IVE
1	EA	DESK MOUNT BUTTON	660-PB	SCE
1	EA	POWER SUPPLY	PS902 900-4RLFA (SHARED W/ ADJACENT GATE)	SCE
1	EA	FINGER GUARD	2248A-46"	NGP

FUNCTION: MAGNETIC LOCK.
GATE NORMALLY CLOSED - MAGNETIC LOCK RELEASED BY DESK-MOUNT BUTTON FOR EGRESS. MAGNETIC LOCK TO RELEASE UPON LOSS OF POWER, SIGNAL FROM FIRE ALARM SYSTEM, OR SIGNAL FROM FIRE COMMAND CENTER.
NOTE: PROVIDE CUSTOM TOP CAP FOR FRAME AT HINGE AND LATCH JAMB.

HW SET: 181P

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	90 DEG OFFSET PULL	8190-0	IVE
1	EA	PUSH BAR	9100	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: PUSH/PULL.

HW SET: 181SN

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
2	EA	DOOR PULL, BACK-BACK MOUNT	RM4010 ARBORMET 36" 5HD (314E X CLEAR COAT MAPLE)	ROC
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	DOOR BOTTOM	355	ZER

FUNCTION: PUSH/PULL.

HW SET: 181ST

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
2	EA	DOOR PULL, BACK-TO-BACK MOUNT	RM2510 SOFTMET 36" 5HD (314E X BLACK SANTOPRENE)	ROC
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	DOOR BOTTOM	355	ZER

FUNCTION: PUSH/PULL.

HW SET: 182H

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CONT. HINGE	112HD	IVE
2	EA	90 DEG OFFSET PULL	8190-0	IVE
2	EA	PUSH BAR	9100	IVE
2	EA	OH STOP & HOLDER	100HP	GLY
2	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
2	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: PUSH/PULL.

HW SET: 213K

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	WALL STOP	WS406	IVE
1	EA	DOOR BOTTOM	5VA	NGP
1	EA	FINGER GUARD	2248A-76"	NGP

FUNCTION: (F84) CLASSROOM LOCK. LATCH RETRACTED BY LEVER EITHER SIDE. OUTSIDE KEY LOCKS/UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 231KP

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PRIVACY W/DB & IND	L9496 OCCUPIED/VACANT	SCH
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	WALL STOP	WS406	IVE
1	EA	FINGER GUARD	2248A-76"	NGP
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: PRIVACY LOCK WITH INDICATOR. OUTSIDE LEVER LOCKED BY OUTSIDE KEY OR INSIDE TURN. OUTSIDE LEVER UNLOCKED BY INSIDE TURN, INSIDE LEVER, OUTSIDE EMERGENCY KEY, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED. OUTSIDE INDICATOR DISPLAYS OCCUPIED/VACANT STATUS.

HW SET: 233K

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CLASSROOM LOCK	ND70 (VERIFY MOUNTING HEIGHT)	SCH
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	WALL STOP	WS406	IVE
1	EA	FINGER GUARD	2248A-76"	NGP
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: (F84) CLASSROOM LOCK.
LATCH RETRACTED BY LEVER EITHER SIDE. OUTSIDE KEY LOCKS/UNLOCKS OUTSIDE LEVER.INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 233P

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CLASSROOM LOCK	ND70 (VERIFY MOUNTING HEIGHT)	SCH
1	EA	SURFACE CLOSER	4050 SRI / 4050 EDA SRI (DROP PLATE AND SPACER AS REQUIRED)	LCN
1	EA	WALL STOP	WS406	IVE
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: (F84) CLASSROOM LOCK.
LATCH RETRACTED BY LEVER EITHER SIDE. OUTSIDE KEY LOCKS/UNLOCKS OUTSIDE LEVER.INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 233X

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CLASSROOM LOCK	L9070 (VERIFY MOUNTING HEIGHT)	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER

FUNCTION: (F05) CLASSROOM LOCK. OUTSIDE LEVER LOCKED AND UNLOCKED BY OUTSIDE KEY. INSIDE LEVER ALWAYS UNLOCKED. AUXILIARY LATCH DEADLOCKS LATCHBOLT WHEN DOOR IS CLOSED.

HW SET: 253KL

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PANIC HARDWARE	LD-78-L (VERIFY MOUNTING HEIGHT)	VON
1	EA	EXIT ALARM KIT	78-ALK-RX	VON
2	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	FINGER GUARD	2248A-76"	NGP
1	EA	DOOR BOTTOM	5VA	NGP

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 253KX

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PANIC HARDWARE	LD-78-L (VERIFY MOUNTING HEIGHT)	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	RAIN DRIP	142 (OMIT AT SHELTERED DOORS)	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	FINGER GUARD	2248A-76"	NGP
1	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 253LX

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PANIC HARDWARE	LD-78-L (VERIFY MOUNTING HEIGHT)	VON
1	EA	EXIT ALARM KIT	78-ALK-RX	VON
2	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	RAIN DRIP	142 (OMIT AT SHELTERED DOORS)	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 253X

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	PANIC HARDWARE	LD-78-L (VERIFY MOUNTING HEIGHT)	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	RAIN DRIP	142 (OMIT AT SHELTERED DOORS)	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER

FUNCTION: CLASSROOM PANIC HARDWARE. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE PUSH PAD RETRACTS LATCH FOR FREE EGRESS.

HW SET: 254KLX

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	ELEC PANIC W/ ALARM	SD-RX-98-NL-OP-ALK	VON
3	EA	KEY CYLINDER	AS REQUIRED	SCH
1	EA	90 DEG OFFSET PULL	8190-0	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER
1	EA	FINGER GUARD	2248A-76"	NGP

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
LATCH DOGGED BY INSIDE CENTER CASE CYLINDER FOR PUSH/PULL OPERATION.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 264E1

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	CONT. HINGE	112HD EPT	IVE
2	EA	POWER TRANSFER	EPT2	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
1	EA	ELEC PANIC HARDWARE	QEL-78-EO	VON
1	EA	ELEC PANIC HARDWARE	QEL-78-NL-OP	VON
3	EA	KEY CYLINDER	AS REQUIRED	SCH
2	EA	90 DEG OFFSET PULL	8190-0	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T	LCN
1	EA	MULLION SEAL	8780	ZER
2	EA	DOOR BOTTOM	5VA	NGP
1	EA	KEY SWITCH	653-14 NS	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	SCE
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
DAYTIME OPERATION: ROTATING KEY SWITCH RETRACTS ELECTRIC LATCH LATCH AND ACTIVATES OUTSIDE PUSH PLATE ACTUATOR FOR PUSH/PULL OR AUTOMATIC OPERATION. NO INSIDE PUSH PLATE ACTUATOR.
NIGHTIME OPERATION: ROTATING KEY SWITCH EXTENDS ELECTRIC LATCH AND DISABLES OUTSIDE PUSH PLATE ACTUATOR. REMOTE PUSH BUTTON MOMENTARILY RETRACTS LATCH AND ENABLES OUTSIDE PUSH PLATE ACTUATOR FOR PUSH/PULL OR AUTOMATIC OPERATION.

HW SET: 264E2

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CONT. HINGE	112HD EPT	IVE
1	EA	POWER TRANSFER	EPT2	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	VON
1	EA	PANIC HARDWARE	LD-78-EO	VON
1	EA	ELEC PANIC HARDWARE	QEL-78-EO	VON
1	EA	KEY CYLINDER	AS REQUIRED	SCH
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T	LCN
1	EA	MULLION SEAL	8780	ZER
2	EA	DOOR BOTTOM	5VA	NGP
1	EA	KEY SWITCH	653-14 NS	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	SCE
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: EXIT-ONLY PANIC HARDWARE WITH ELECTRIC LATCH RETRACTION. NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
DOOR NORMALLY LATCHED. PRESSING INSIDE PUSH PLATE ACTUATOR RETRACTS ELECTRIC LATCH AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 264EX

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	CONT. HINGE	112HD	IVE
1	EA	CONT. HINGE	112HD EPT	IVE
1	EA	POWER TRANSFER	EPT2	VON
1	EA	KEYED REMOVABLE MULLION	KR4954	VON
1	EA	PANIC HARDWARE	CD-78-EO	VON
1	EA	ELEC PANIC HARDWARE	CD-LX-78-NL-OP	VON
2	EA	KEY CYLINDER	AS REQUIRED	SCH
2	EA	90 DEG OFFSET PULL	8190-0	IVE
2	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050 / 4050 EDA (DROP PLATE / SPACER AS REQD)	LCN
1	EA	SURF. AUTO OPERATOR	4642	LCN
1	EA	ACTUATOR, JAMB MOUNT	8310-818T	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-856T	LCN
1	EA	WEATHERSTRIPPING	BY DOOR/FRAME SUPPLIER	
1	EA	MULLION SEAL	8780	ZER
2	EA	DOOR BOTTOM	15NA	NGP
1	EA	THRESHOLD	8655A	ZER
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
DAYTIME OPERATION: LATCH HELD RETRACTED BY INSIDE KEY FOR PUSH/PULL OPERATION. LX SWITCH ACTIVATES ACTUATORS FOR AUTOMATIC OPERATION.
NIGHTTIME OPERATION: LATCH RELEASED BY INSIDE KEY FOR NIGHTLATCH OPERATION. LX SWITCH DEACTIVATES ACTUATORS WHILE DOOR IS LOCKED.

HW SET: 951L

QTY		DESCRIPTION	CATALOG NUMBER	MFR
1	EA	GATE SPRINGS	450	MCK
1	EA	EXIT HARDWARE W/ ALARM	V40EB X W (VERIFY MOUNTING HEIGHT)	DET
1	EA	KEY CYLINDER	AS REQUIRED	SCH

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.

HW SET: 961L

QTY		DESCRIPTION	CATALOG NUMBER	MFR
2	EA	GATE SPRINGS	450	MCK
1	EA	FIXED MULLION	BY DOOR/FRAME SUPPLIER	
2	EA	EXIT HARDWARE W/ ALARM	V40EB X W (VERIFY MOUNTING HEIGHT)	DET
2	EA	KEY CYLINDER	AS REQUIRED	SCH

FUNCTION: EXIT-ONLY PANIC HARDWARE - NO OUTSIDE TRIM. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS.
WHEN ARMED, PUSHING INSIDE PUSH PAD SOUNDS INTERNAL ALARM HORN UNTIL DISARMED OR RESET. INSIDE KEY CYLINDER ARMS/DISARMS/RESETS ALARM.
FIXED CENTER MULLION BY GATE SUPPLIER REQUIRED FOR LATCHING HARDWARE.

END OF SECTION

SECTION 08 81 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated glass and glazing:
   1. Entrances and storefronts
   2. Curtainwall

B. Monolithic Glazing:
   1. Interior doors and side-lites
   2. Glazed decorative handrails
   3. Shower doors

C. Unframed mirrors and metal trim

D. Glazed food service fixtures and metal trim

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 05 70 00 - Decorative Metal.

E. Section 05 73 13 - Glazed Decorative Metal Railings.

F. Section 08 08 00 - Commissioning of Openings.

G. Section 08 11 13 - Hollow Metal Doors and Frames.

H. Section 08 14 16 - Flush Wood Doors.

I. Section 08 38 00 - Traffic Doors.

J. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

K. Section 08 44 13 - Glazed Aluminum Curtain Walls.

L. Section 08 71 00 - Door Hardware.

M. Section 08 87 13 - Solar Control Film.

N. Section 09 21 16 - Gypsum Board Assemblies.

O. Section 10 28 19 - Glass Shower Doors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C1036 - Standard Specification for Flat Glass; 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

G. ASTM E576 - Standard Test Method for Frost/Dew Point of Sealed Insulating Glass Units in the Vertical Position; Current Edition.

H. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance; 2019.

I. ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units; 2019.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

K. ASTM E2358 - Standard Specification for the Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades; 2017.

L. CPSC 16CFR1201 - SAFETY STANDARD FOR ARCHITECTURAL GLAZING MATERIALS; 2016.

M. GSA CID A-A-3002 - Mirrors, Glass; 1996.

N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

P. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.

Q. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

R. FGMA Glazing Manual - Flat Glass Marketing Association.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR1201.

C. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual for glazing installation methods.

D. Provide insulating glass units permanently marked with certification label of Insulating Glass Certification Council (IGCC) indicating compliance with Class CBA.

E. Fire Rated Door Assemblies: Provide 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, based on testing according to NFPA 252.

F. Fire Rated Window Assemblies: Provide 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, based on testing according to NFPA 257.

1.05 SUBMITTALS

A. Material and Equipment Submittals: Submit the following under provisions of Section 01 33 00-Submittals:
   1. Product Data:
      a. Glass Units: Provide product data indicating compliance with specified requirements. Include information on size limitations, special handling or installation requirements.
      b. Glazing Sealant: Provide data on glazing sealant. Identify colors available.
      c. Calculations prepared by a professional engineer, licensed in the state in which the project is located, for the design of all glass units and showing that the glass units meet the building code.
   2. Samples for Verification:
      a. Glass Units: Submit three 12" x 12" samples of each type of tinted insulating glass specified. Submit Insulating Glass samples with Project specific features such as spacer bar and hermetic seal construction, low-E coatings and other specified features. Samples shall show extremes of variation / range of appearance if applicable.
      b. Laminated Glass: Submit three 12” x 12” samples of each type of laminated glass for final approval of interlayer color.
      c. Glazing Sealant: Submit color samples for color selection.

B. Quality Assurance Submittals: Submit the following under provisions of Section 01 40 00:
   1. Manufacturer's Certificate: Submit sealed glass unit manufacturer's certificate indicating units meet or exceed specified to requirements.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Closeout Submittals: Submit the following under provisions of Section 01 77 00.
   1. Warranty: As specified in this Section.

1.06 WARRANTY

A. Insulating Glass: Provide written ten year manufacturer's warranty, including coverage of sealed glass units from seal failure due manufacturing defects, as evidenced by inner-pane dusting or misting, and replacement of same.

B. Provide written ten-year warranty covering reflective coating against peeling, and other indications of deterioration in reflective coating.

1.07 DEFINITIONS

A. GANA – Glass Association of North America.

PART 2 PRODUCTS

2.01 GLASS PRODUCTS

A. Solar Control Low-E Clear Insulated Glass Units: IGCC Class CBA when tested according to ASTM E2188, ASTM E2189, ASTM E2190; dual sealed unit with primary polyisobutylene seal, secondary silicone seal and 1/2" airspace. Glass edges shall be clean scored and cut.
   1. Provide Fully Tempered glass where indicated per glass types.

B. Fully Tempered Clear Glass: ASTM C1048 Type I, Class 1, q3, Kind FT, horizontally tempered; 1/4" thick unless noted otherwise.

C. Heat-Strengthened Float Glass: ASTM C1036, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.

D. Clear Float Glass: ASTM C1036, Type I, Class 1, q3; 1/4" thick unless noted otherwise.

E. Laminated Glass: ASTM C1172, and complying with testing requirements in 16 CFR 1201 for category II Materials. 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 as specified per glass type.
   2. Interlayer Thickness: Provide thickness not less than indicated in glass type.
   3. Interlayer Color: Clear unless otherwise indicated.

F. Spacer Bar and hermetic seal requirements:
   1. Hermetic seal to consist of Polyisobutylene (Butyl) Primarily and Silicone Secondary seal. Primary and Secondary seals shall be uniform and continuous. Hermetic seals shall also meet the following requirements:
      a. Secondary seal shall extend from exterior face of inner glass pane to interior face of exterior glass pane and shall not contain any of the contaminants or imperfections described below.
      b. Primary seal shall not contain fingerprints, dirt, debris, or any other contaminants or interruptions that may affect adhesion or continuity of the seal.
      c. Primary seal shall not be reduced to less than 1/8” in width at any point along the perimeter of the Insulated Glass Unit or 1/32” in thickness (side spacer shall not be visible through a “transparent” layer of thin primary seal)
      d. Primary and secondary seal shall not contain voids and must be continuously bonded to the surface of the glass.
      e. Units shall carry CBA Rating as established by ASTM E774 and shall have an initial frost point less than -60 degrees F when tested per ASTM E576.

G. Solar Control Film: Where Glass type is followed by a "T" (e.g. G-1T), apply Solar Film as specified in section 08 87 13 - Solar Control Film.

2.02 INSULATED GLASS UNITS

A. Solar Control Coated, Low E Insulating Clear Glass (G-1)
   1. Basis of Design Product: Vitro Architectural Glass (formerly PPG)
   2. Overall Unit Thickness: 1”
   3. Indoor Lite: 1/4” clear float glass.

4. 1/2” Airspace.
5. Outdoor Lite: 1/4” clear glass.
6. Low E coating: Installed on second surface (#2)
    a. Solarban 70 Solar Control Low-E by Vitro Architectural Glass (formerly PPG)

B. Solar Control Coated, Low E Insulating Clear – Fully Tempered Glass (G-2)
1. Basis of Design Product: Vitro Architectural Glass (formerly PPG)
2. Overall Unit Thickness: 1”
3. Indoor Lite: 1/4" thick clear, fully tempered glass.
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear, fully tempered glass.
6. Low E coating: Installed on second surface (#2)
    a. Solarban 70 Solar Control Low-E by Vitro Architectural Glass (formerly PPG)

C. Insulating Spandrel Glass (G-3)
1. Basis of Design Product: Oldcastle Insulating Glass.
2. Overall Unit Thickness: 1”
3. Indoor Lite: 1/4" thick clear fully tempered glass.
    a. Coating: Harmony Solex Spandrel on fourth surface (#4)
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear heat-strengthened float glass.

D. Insulating Frosted Glass (G-9)
1. Basis of Design Product: Vitro Architectural Glass (formerly PPG)
2. Overall Unit Thickness: 1”
3. Indoor Lite: Two (2) pieces 1/8" thick Clear Float Glass, laminated.
    a. Interlayer Thickness: 0.030”
    b. Interlayer Color: White frosted; “Arctic Snow” by Oldcastle or equivalent.
4. 1/2” Airspace Outdoor Lite: 1/4" thick clear float glass.
5. Low E coating: Installed on second surface (#2)
    a. Solarban 70 Solar Control Low-E by Vitro Architectural Glass (formerly PPG)

E. Insulating Frosted Safety Glass (G-10)
1. Basis of Design Product: Oldcastle Insulating Glass.
2. Overall Unit Thickness: 1”
3. Indoor Lite: Two (2) pieces 1/8" thick Clear Float Glass, laminated.
    a. Interlayer Thickness: 0.030”
    b. Interlayer Color: White frosted; “Arctic Snow” by Oldcastle or equivalent.
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear fully tempered glass.

F. Insulating Fully Tempered Safety Glass (G-11)
1. Basis of Design Product: Oldcastle Insulating Glass.
2. Overall Unit Thickness: 1”
3. Indoor Lite: 1/4" thick clear fully tempered glass.
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear fully tempered glass.

G. Insulating Fully Tempered Spandrel Glass (G-13)
1. Basis of Design Product: Oldcastle Insulating Glass.
2. Overall Unit Thickness: 1”
3. Indoor Lite: 1/4" thick clear fully tempered glass.
    a. Coating: Harmony Solex (ICD High Performance Coatings 2-743 or equal) Spandrel on fourth surface (#4)
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear fully tempered glass.

H. Insulating Clear Glass (G-14)

1. Basis of Design Product: Oldcastle Insulating Glass.
2. Overall Unit Thickness: 1”
3. Indoor Lite: 1/4" thick clear float glass.
4. 1/2” Airspace.
5. Outdoor Lite: 1/4" thick clear float glass.

2.03 MONOLITHIC GLASS UNITS

A. Clear Float Glass (G-4)
   1. 1/4" thick clear float glass.

B. Clear Fully Tempered Glass (G-5)
   1. 1/4" thick clear fully tempered glass.

C. Laminated Safety Glass (G-6)
   1. Overall Unit Thickness: 1/2”
   2. Two (2) pieces of 1/4” clear float glass, laminated.
      a. Polished glass edges.
   3. Interlayer Thickness: 0.030”
   4. Interlayer Color: Clear.

D. Frosted Laminated Safety Glass (G-7)
   1. Overall Unit Thickness: 1/4"
   2. Two (2) pieces of 1/8” clear float glass, laminated.
      a. Polished glass edges.
   3. Interlayer Thickness: 0.030”
   4. Interlayer Color: “Arctic Snow” by Oldcastle or equivalent.

E. Acid-Etched, Fully Tempered Glass (G-8) (Shower Doors)
   1. 3/8” thick fully tempered glass.
   2. One Side polished: Polished side shall face interior of shower stall.
   3. One Side Acid-Frosted, obscure.

F. Clear Fully Tempered, Laminated Glass (Glass Guard Rail) (G-15)
   1. Type 1, Clear Laminated Glass, 2 layers. Polyvinyl Butyl (PVB) interlayer.
      a. Interlayer Thickness: 0.030” min.
      b. Total thickness as required by structural load, but not less than 1/2" (12 mm)
   2. Meets or exceeds ASTM E2358.

G. Fully Tempered Clear Glass (G-16)
   1. Glass: Tempered float glass meeting requirements of ASTM C1036, Type I, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT.
   2. Thickness: 1/2"

2.04 UNFRAMED MIRROR GLASS AND TRIM

A. Unframed Mirror Glass: GSA CID A-A-3002, 1/4" thick. Provide fully adhered mirrors where mirror glass extends to within 18” of the floor. Comply with ASTM C1503. Provide pencil polished edge treatment at vertical butt joints. Miter mirror glass at inside corners.
   1. Safety Glass: Where required by code, glass shall be laminated and heat-strengthened. Laminated and heat-strengthened glass shall conform to ASTM C1048 (for heat-strengthened glass) and ASTM C1172 (for laminate glass) and the following requirements:
      a. Consumer Product Safety Commission Standard 16 CFR 1201.
      b. Safety Certification council.
      c. ANSI Z97.1
      d. Local Codes, whichever is most stringent.
   2. Safety Tape: Where Safety Glass is not otherwise required, provide and install safety tape backing at all Unframed Mirror Glass.
      a. Basis of Design: C.R. Laurence, CRL White Category II Shatterproof Safety Tape for Mirrors; Sized as required.

B. Mirror Types:
   1. MIR-1:
      a. Tint: None
      b. Location: Typical unless noted otherwise.
   2. MIR-2:
      a. Tint: Gray
      b. Location: Yoga, MB360 and Yoga Foyer.

C. Unframed Mirror J Molding:
   1. Product: Stylmark, Inc. 420107.
   2. Locations:
      a. At multiple piece mirrors: Top, bottom and outside corner terminations.
      b. At single piece mirrors: Top, bottom and both sides.
   3. Size: J-molding (5/8”) or equal.
   4. Finish:
      a. Typical: No. 128 Buffed Satin Stainless Steel.
      b. Group Fitness, Barre & ADA Mirrors: 22BRN80049.
      c. Or approved equal.
   5. Miter all corners.

D. Unframed Mirror Mastic. Provide MDI polymer based, low VOC mirror mastic compliant with SCAQMD 1168 rule 51 < 250 g/L:
   1. CRL Palmer Mirro-Mastic.
   2. Or approved equal

E. Double-Sided Mirror Divider:
   1. Product: Stylmark, 510000X031.
   2. Color: #216 Brushed Brite Brown.
   3. Location: Locker Room Vanities.

F. Backlit mirror edge:
   1. Product: Stylmark Angle 110728.
   2. Location: Pilates, Yoga, Yoga Foyer, CTR
   3. Color: 22BRN80049

2.05 GLAZED FOOD SERVICE FIXTURES

A. Sneeze Guard:
   1. Glazing:
      a. 1/4" Fully Tempered Glass (G-5).
      b. Ease all exposed edges.
      c. Miter corners.
      d. Panel sizes:
         1) See drawings.
   2. Metal Structure:
      a. Manufacturer: Stylmark.
      b. 1" x 1" Sill.
      c. Part Number: 110361.
      d. Hardware: As necessary for field assembly.
      e. Color: All metal components: 216 Brushed Brite Brown.
      f. Anchors: Coordinate with Casework. See details.

2.06 GLAZING ACCESSORIES AS RECOMMENDED IN GANA GLAZING MANUAL

A. Silicone Glazing Sealant: Specified in Section 07 92 00 - Joint Sealers. Ensure compatibility with silicone.

B. Setting Blocks: Neoprene; 80-90 Shore A durometer hardness. Ensure compatibility with silicone.

C. Edge Blocks/Shims: Neoprene; 60-70 Shore A durometer hardness. Ensure compatibility with silicone.

D. Glazing Tape: Preformed butyl compound coiled on release paper; properly sized for application, black/bronze color. Tremco, 440 Tape. Ensure compatibility with silicone.

E. Glazing Clips: Manufacturer's standard type. Ensure compatibility with silicone.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.

B. Beginning of installation means acceptance of substrate.

3.02 ALUMINUM, ENTRANCES, STOREFRONTS AND CURTAIN WALL SYSTEM

A. Glaze aluminum entrances and storefronts and curtain wall system in accordance with manufacturer's glazing instructions.

3.03 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16" above sightline.

B. Place setting blocks at quarter points.

C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.

D. Install removable stops, spacer shims inserted between glass, and applied stops at 24" intervals, 1/4" below sightline.

E. Fill gap between pane and applied stop with silicone sealant to depth equal to bite of frame on pane to uniform and level line.

F. Trim protruding tape edge.

3.04 UNFRAMED MIRROR GLASS

A. Install Safety Tape at all non-safety unframed mirror glass in accordance with safety tape manufacturer’s instructions.

B. Install tape in shop environment prior to delivering to site whenever possible.

C. Hold tape edges back from edge of mirror sufficient to prevent visibility after installation.

3.05 CLEANING

A. After installation, mark pane with an "X" by using plastic tape or removable paste.

B. Remove glazing materials from finish surfaces.

C. Remove labels after work is completed.

END OF SECTION

SECTION 08 87 13
SOLAR CONTROL FILM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solar control film applied to glass.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

E. Section 08 44 13 - Glazed Aluminum Curtainwall.

F. Section 08 81 00 - Glazing.

1.03 REFERENCES

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

C. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.

D. LBNL WINDOW SOFTWARE - A computer program for calculating total window thermal performance indices (i.e. U-values, solar heat gain coefficients, and visible transmittances).

E. NFRC 100/200 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

1.04 PERFORMANCE REQUIREMENTS

A. Flammability: Meets surface burning characteristics in accordance with ASTM E84 Class A
   1. Flame Spread Index = < 25
   2. Smoke Development Index = < 450

B. Volatile Organic Compound Content:
   1. Compliant with the performance standard established for low-emitting materials under the CDPH, the Collaborative for High Performance Schools (CHPS) and the LEED v4 programs.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Physical properties and independent testing agency reports showing compliance with specified tests.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Detailing installation of film, anchoring accessories, and/or sealant.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing the actual product, color, and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

G. Manufacturer's warranty information.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer Qualifications: Products specified shall be a standard product of a manufacturer regularly engaged in the manufacturing and distribution of such products for a minimum of 10 years.
   1. Provide a Quality Management certificate stating the manufacturing facility's location conformance with ISO 9001.
   2. Provide an Environmental Management certificate stating the manufacturing facility's location conformance with ISO 14001.

C. Installer Qualifications: Documented experience in the application of self-adhesive window films with at least 3 applications of similar size and complexity, and approved by the solar film manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Store products indoors in manufacturer's unopened packaging until ready for installation.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. Provide film manufacturer's limited warranty against failure of film, including peeling, bubbling, rippling, cracking, delamination and demetallization; includes cost of material and labor for removal and reinstallation. Duration of warranty shall be as follows:
   1. Twelve (12) Year Limited Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Solar Gard®, which is located at: 4540 View Ridge Ave.; San Diego, CA 92123; Toll Free Tel: 866-572-1922; Tel: 858-576-0200; Email: info@solargard.com; Web:www.solargard.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 SOLAR CONTROL FILM

A. For use in Gymnasium (excluding Kid's Gym) and indoor Pickleball areas, where indicated.
   1. Solar Gard TrueVue 5 solar control film shall have the following nominal properties when applied to 1/4 inch (6 mm) clear glass with pressure sensitive adhesive calculated using NFRC methodology and LBNL Window software.
      a. Film Performance Results, Nominal
         1) Film Color: Grey
         2) Visible Light Transmittance: 5 percent
         3) Visible Light Reflectance: (Exterior) 44 percent
         4) Visible Light Reflectance: (Interior) 8 percent
         5) Total Solar Energy Rejected: 79 percent
         6) Solar Heat Gain Coefficient: .21
         7) U-Factor Btu/h-ft² F (Winter): .98
         8) Solar Transmittance: 5 percent
         9) Solar Absorptance: 54 percent
         10) Solar Reflectance: 41 percent
         11) Ultraviolet Light Blocked (300-380 nanometers): > 99 percent
         12) UV Tdw-ISO @ 300 to 700 nm: 4 percent

B. For use in other indicated areas.

1. Solar Gard TrueVue 15 solar control film shall have the following nominal properties when applied to 1/4 inch (6 mm) clear glass with pressure sensitive adhesive calculated using NFRC methodology and LBNL Window software.
    a. Film Performance Results, Nominal
        1) Film Color: Grey
        2) Visible Light Transmittance: 15 percent
        3) Visible Light Reflectance: (Exterior) 44 percent
        4) Visible Light Reflectance: (Interior) 23 percent
        5) Total Solar Energy Rejected: 77 percent
        6) Solar Heat Gain Coefficient: .23
        7) U-Factor Btu/h-ft² F (Winter): .98
        8) Solar Transmittance: 8 percent
        9) Solar Absorptance: 51 percent
        10) Solar Reflectance: 41 percent
        11) Ultraviolet Light Blocked (300-380 nanometers): > 99 percent
        12) UV Tdw-ISO @ 300 to 700 nm: 10 percent

PART 3 EXECUTION

3.01 EXAMINATION

A. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Glass surfaces should be inspected for defects including scratches or defects which will affect the final appearance.

C. Do not begin installation until substrates have been properly inspected.

D. Coordinate location of windows where film is to be installed with Drawings and Architect.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions. Installation must be accomplished by a recognized professional installer of film for energy control purposes or safety and security purposes. Completed work must meet IWFA visual acceptance standard.

B. Install without bubbles, ripples, drips, dirt, cuts, tears or gaps between film and frame.

C. Clean newly installed film and window frames after installation.

D. Clean up cleaning solutions, run-off cleaning water and adhesive mounting solution.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Where installed film could be damaged by subsequent construction provide tape warning strips or barricades to prevent contact.

END OF SECTION

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SECTION 09 00 10
DIVISION 9 TABLE OF CONTENTS

1.01 DIVISION 09 – FINISHES

09 05 61 - Common Work Results for Flooring Preparation
09 21 16 - Gypsum Board Assemblies
09 21 17 - Gypsum Board Shaft Wall Assemblies
09 30 00 - Tiling
09 30 01 - Tiling Schedules
09 51 13 - Acoustic Panel Ceilings
09 51 14 - Acoustic Panel Ceilings Schedule
09 54 23 - Linear Metal Ceilings
09 62 38 - Tile Wet Area Surfacing
09 64 00 - Wood Flooring
09 64 01 - Wood Flooring Schedule
09 65 19 - Resilient Flooring
09 65 20 - Resilient Flooring Schedule
09 67 23 - Resinous Flooring
09 72 00 - Wall Coverings
09 72 01 - Wall Coverings Schedules
09 75 00 - Interior Stone
09 75 01 - Interior Stone Schedule
09 77 50 - Vertical Surfacing Panel System
09 84 30 - Sound Absorbing Wall and Ceiling Units
09 91 00 - Painting
09 91 01 - Painting Schedules

END OF SECTION

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SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient flooring.
   2. Resinous flooring.
   3. Ceramic tile and stone tile.

B. Preparation of new concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Patching compound.

F. Remedial floor coatings.

G. Remedial floor sheet membrane.

1.02 RELATED REQUIREMENTS

A. Section 01 22 00 - Unit Prices: Bid pricing for remediation treatments if required.

B. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.

C. Section 01 84 21 - Interior Concrete Floor Finishing Quality Requirements.

D. Section 03 30 00 - Cast-in-Place Concrete: Concrete compostition, curing, tolerances and admixtures.

E. Section 09 30 00 - Tiling.

F. Section 09 65 19 - Resilient Flooring.

G. Section 09 67 23 - Resinous Flooring.

1.03 PRICE AND PAYMENT PROCEDURES

A. Unit Prices: See Section 01 22 00 - Unit Prices.

B. Unit Price for Alternate Flooring Adhesive: Do not include the cost of the alternate adhesive in the base bid; state on the bid form the unit price per square foot (square meter) for using the alternate adhesive, in the event such remediation is required.

C. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot (square meter) for the floor coating or underlayment, installed, in the event such remediation is required.

1.04 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. ASTM F3311 - Standard Practice for Mat Bond Evaluation of Performance and Compatibility for Resilient Flooring System Components Prior to Installation; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Temperature:
      a. Ambient Air
      b. Substrate Surface
   4. Moisture and alkalinity (pH) test reports.
   5. Surface Porosity.
   6. Subfloor Flatness.
   7. Copies of specified test methods.
   8. Recommendations for remediation of unsatisfactory surfaces.
   9. Product data for recommended remedial coating.
   10. Submit report to Architect.
   11. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report. (ASTM F3311-19)

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Construction Manager's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
   3. Products:
      a. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
      b. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   2. Use product recommended by testing agency.

D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: 28 mil (0.028 inch) (0.711 mm).
   2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
   3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.
   8. Adhesive bond and compatibility test.
   9. Protection.

C. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Correction of uneven concrete surface.
1. Grind high spots down.
2. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
3. Do not fill expansion joints, isolation joints, or other moving joints.
4. Prepared surfaces shall conform to the levelness requirements of the floor covering manufacturer, or no more than 3/16" / 10,' whichever is more stringent.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.09 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
      a. Standard Gypsum Board.
      b. Type X.
      c. Type C.
      d. Flexible Type.
      e. High Impact Type.
      f. Moisture Resistant Type.
      g. Glass Mat Sheathing.
   2. Tile backing panels.
      a. Glass Mat Backing Panels.
      b. Cementitious Backing Panels.
   3. Exterior sheathing.
   4. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, canopies, etc.).
   5. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
   6. Isolated ceiling system (e.g. engineered gypsum board system)
   7. Partition gap closure accessories (between partition and curtain wall)

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 05 12 00 - Structural Steel Framing.

F. Section 05 21 00 - Steel Joist Framing.

G. Section 05 31 00 - Steel Decking.

H. Section 05 40 00 - Cold-Formed Metal Framing.

I. Section 06 10 00 - Rough Carpentry.

J. Section 07 81 00 - Applied Fireproofing.

K. Section 07 84 00 - Firestopping.

L. Section 07 92 00 - Joint Sealants.

M. Section 08 31 13 - Access Doors and Frames.

N. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

1.03 REFERENCE STANDARDS

A. AISI American Iron and Steel Institute; LRFD Design Manual.

B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

H. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

I. ASTM C365/C365M - Standard Test Method for Flatwise Compressive Properties of Sandwich Cores; 2022.

J. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

K. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

L. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

M. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

N. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

O. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

P. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

Q. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

R. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

S. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.

T. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

U. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

V. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

W. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

X. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

Y. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

Z. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

AA. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

BB. ASTM E413 - Classification for Rating Sound Insulation; 2022.

CC. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

DD. ASTM E1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; Current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. All non-structural steel framing members, including studs and runners shall meet the requirements of ASTM C645.
   a. Provide galvanized coatings on all members consistent with ASTM and industry standards and as otherwise specified.
2. Construct typical walls and framing in accordance to ASTM C754 Applying the design criteria below.
3. Design Loads (use governing load cases):
   a. 5 psf differential pressure (IBC 1607.13) minimum.
   b. As indicated on drawings.
   c. Seismic loading per ASCE 7, Chapter 13, and section 13.5.8, for Seismic Design Categories C, D, E and F. See Architectural Drawings Sheet G003 for Seismic Design Category designation.
   d. 12 psf dead load for ceilings with rigid finishes (tile or wood)
4. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior Wall Framing: Design wall framing to meet the following horizontal deflection conditions:
      1) Typical Conditions: L/180 of wall height.
      2) Rigid Finishes Wall and Ceiling (Tile): L/240
      3) Headers: Vertical deflection of L/240 or ½" max
5. Jamb studs around openings shall be capable of resisting tributary load applied from supporting members using common engineering practices. The deflection criteria for the jamb member shall meet or exceed L/120.
6. Walls with gypsum board on both sides full height are to be sized using the Maximum Stud Height tables in ASTM C754.
7. Walls without gypsum board on both sides full height shall have horizontal bridging or blocking per manufacturer instructions.
8. The use of powder activated fasteners to make connection to precast concrete is allowed with manufacturer approval through a fastener testing program. In some cases, the precast concrete produced achieves greater concrete compressive strengths than allowed by the powder activated manufacturer specification.
9. Provide soffit bracing to resist loading requirements specified.
10. 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. Floors: Upward and downward movement of 1.0 inch (25 mm).
    b. Roof – Typ: Upward and downward movement of 1.5 inch (38 mm)
    c. Roof – Long Span Tees (> 50 ft): Upward movement of 1.5 inch and downward movement of 3.0 inch (75 mm)
11. Field conditions observed by the Architect, Engineer, or building official deemed to be unacceptable shall be reviewed by a qualified professional engineer hired by the light gauge installer at no additional cost to the owner. Conditions in question will require engineered design prepared by a qualified professional engineer registered in the jurisdiction where the project is located to validate the existing design or corrective actions required to meet project specifications.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Submit fabrication and erection shop drawings for approval prior to fabrication of framing. Indicate details of connections or welds, and manufacturer of connections.

C. Certified Shop (erection) Drawings: Submit signed and certified fabrication and erection Shop Drawings for approval prior to fabrication for framing components subject to seismic loading per ASCE 7, Chapter 13, and section 13.5.8 (Seismic Design Categories C, D, E, F), and for any additional components as indicated on drawings as "Engineered by Fabricator".

1. Show layout, spacing, sizes, thicknesses and types of cold-formed metal framing, fabrication and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details and attachment to adjoining work.
2. Provide complete design calculations for each part of system and each condition including studs, runner channels, hangers and fasteners.

D. Submit certification that all steel components meet specified galvanization or alternate coatings as specified.

E. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

F. Qualification Data: for professional engineer.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Engineering Responsibility: Preparation of shop drawings, design calculations and other structural data by a qualified professional engineer.

C. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Design Confirmation: For items indicated as “Engineered by Fabricator” provide letter of confirmation that the work of this section has been designed by a qualified professional engineer registered in the jurisdiction where the project is located.

E. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

F. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.07 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.02 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM E84 and ASTM C365/C365M or ASTM C1396/C1396M as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. G-P Gypsum.
      c. National Gypsum Company.
      d. USG Corporation.
      e. PABCO Gypsum.
      f. CertainTeed Corp.

B. Standard Gypsum Board: Use where no more stringent requirements are called for.
   1. Thickness 5/8."
   2. Long Edges: Tapered.
   3. Surfaced with paper on front, back and long edges.

C. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Fire resistance rating: ASTM 1396; 1hr per 5/8" thickness.
   3. Long Edges: Tapered.

D. Type C:
   1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   2. Long Edges: Tapered.

E. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Long Edges: Tapered.

F. High-Impact Type: Manufactured with Type X core, with high impact and mold resistance.
   1. Core: 5/8 inch (15.9 mm) thick.
   2. Reinforcement: Internal Fiberglass mesh or equivalent: Meets or exceeds ASTM C1629/C1629M level 3 for both Hard and Soft body impacts.
   3. Mold Resistance: Meets ASTM D3273 level 10.

G. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Mold Resistance: Meets ASTM D3273 level 10.
   3. Long Edges: Tapered.

H. Indoor Pool Room Type: Glass-Mat Gypsum Sheathing Board, ASTM C1177/C1177M.
   1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
   2. 5/8 inch (15.6 mm), regular type.

2.03 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:
   1. Complying with ASTM C1178/C1178M.
      a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
   2. Thickness as shown on drawings.
   3. Fire rating: as shown on drawings.

B. Cementitious Backer Units: ANSI A118.9. (Cement Board)
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Custom Building Products; Wonderboard.
      b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      c. USG Corporation; DUROCK Cement Board.
   2. Thickness:
      a. 1/2 inch (12.7 mm) typical.
      b. 5/8 inch at steam room ceilings.

2.04 EXTERIOR GYPSUM BOARD SHEATHING

A. Exterior Gypsum Sheathing: ASTM C1396/C1396M, with manufacturer's standard edges.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. G-P Gypsum.
      c. National Gypsum Company.
      d. USG Corporation.
   2. Core: 1/2 inch (12.7 mm), regular type.

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M.
   1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
   2. 5/8" (15.6 mm), regular type.

2.05 PANEL FASTENERS:

A. Self-drilling, self-tapping steel screws.
   1. For steel framing less than 0.03 inch thick: Comply with ASTM C1002.
      a. For steel framing from 0.033 inch thick to 0.112 inch thick: Comply with ASTM C954.
      b. For wood framing: 8-18 x 0.323 ribbed drywall nail.
      c. Fastener length: for steel min. ¾” over panel thickness; for wood min. 1” over panel thickness.
      d. Corrosion-resistance: Coating to resist rust for a min. of 48 hours per ASTM B117.
      e. Maximum fastener spacing 8” o.c. for vertical surfaces and 6” o.c. for ceilings.

2.06 TRIM ACCESSORIES

A. General Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. General Exterior Trim: ASTM C1047.
   1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Reveals and Moldings:
   1. (REG-1) Basis of Design:

a. Manufacturer: Fry Reglet Architectural Metals; https://fryreglet.com/reveals-and-moldings.
   1) Substitutions: In accordance with Section 01 60 00 Product Requirements.
b. Product ID: DRM-625-100.
c. Description / Size: 5/8"D x 1"H pre-finished reveal.
d. Finish: Powder Coat, Dark Bronze (factory finished)
e. Location: LT Recover, horizontal datum in Strength Area.
f. Contact: Steve Delvo, stevedelvo@fryreglet.com, (253) 507-6095

D. High Impact Corner Protection:
   1. Inpro Architectural Products. "Aluminum Corner Guard"
      a. Leg Dimension: 1/2" or as indicated on drawings.
      b. Length: as indicated on drawings
      c. Finish: Bronze
      d. To be used on wall and soffit outside corners where high-impact Gypsum bd is indicated on drawings.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:
   1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.08 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
   1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. See Section 07 21 00 - "Thermal Insulation" for more information.

E. Thermal Insulation: As specified in Section 07 21 00 - "Thermal Insulation.

F. Vapor Retarder: As specified in Section 07 27 01 - "High Performance Vapor Retarder"

G. Gypsum Board Adhesives: High performance latex-based construction adhesive designed for gypsum board applications.
   1. Green Series SW-325 Shear & Drywall Adhesive by OSI.
   2. Green Drywall Adhesive by Grabberman.
   3. Or approved Substitution.

H. Acoustical Sealant: Sheetrock Acoustical Sealant by USG or equal.
   1. For gypsum board to gypsum board and gypsum board to structural joints: USG Acoustical Sealant or equal, non-hardening sealant specifically for gypsum board joints.

I. For penetrations at fire-rated construction, provide firestopping as specified in Sections “Firestopping” and “Applied Fireproofing”.

2.09 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 and ASTM A653/A653M requirements for metal, unless otherwise indicated.
   2. Coatings:
      a. General: Provide minimum G40 coating or EQ equivalent on all components except as otherwise indicated.
      b. Provide minimum G90 coating or EQ equivalent on all components within or adjacent to the following areas: Indoor Pool Room and Locker Room Wet Areas, including Showers Areas, Steam Rooms and Whirlpool Suites as indicated on Drawings.

2.10 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488/E488M by an independent testing agency.
      a. Type: 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 E1190 by an independent testing agency.

C. Sound Isolation Ceiling Hangers:
   1. Provide manufactured Isolation Ceiling Hangers and required components as part of engineered isolation ceiling system indicated on Drawings. Determine appropriate model and accessories required for complete installation.
      a. Manufacturer/Products: Subject to compliance with requirements, provide one of the following:
         1) Mason Industries, Inc., “30NCC”; www.Mason-Ind.com.
         2) Kinetics Noise Control, “ICC Isolation Hanger”; www.kineticsnoise.com
         3) Or approved equal.

D. Sound Isolation Clips:

1. Provide manufactured Isolation Ceiling clips and required components as part of engineered isolation ceiling system indicated on Drawings. Determine appropriate model and accessories required for complete installation.
    a. Manufacturer/Products: Subject to compliance with requirements, provide one of the following:
        1) PAC International, Inc, "RSIC-1" Sound Isolation Clips; www.pac-intl.com.
        2) Kinetics Noise Control, "IsoMax"; www.kineticsnoise.com
        3) PLITEQ, "GenieClip"; www.pliteq.com
        4) Or approved equal.

E. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

F. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.

G. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
1. Depth: 2-1/2 inches (64 mm).
2. At ceilings and soffits to receive tile. Brace as required to reduce upward deflection.

H. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C645.
    a. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
    b. Depth: As indicated on Drawings.
3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22.2 mm) deep.
    a. Minimum Base Metal Thickness: As indicated on Drawings.
4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.

I. Grid Suspension System for Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    b. Chicago Metallic Corporation; Drywall Furring System.
    c. USG Corporation; Drywall Suspension System.

2.11 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
1. Coatings:
    a. General: Provide minimum G40 coating or EQ equivalent on all components except as otherwise indicated.
    b. Provide minimum G90 coating or EQ equivalent on all components within or adjacent to the following areas: Indoor Pool Room and Locker Room Wet Areas, including Showers Areas, Steam Rooms and Whirlpool Suites as indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure 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.

D. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
   2. Depth: 7/8 inch (22.2 mm).

E. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

F. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: 3/4 inch (19.1 mm).
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

G. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

H. Stud Isolation Strips:
   1. Provide Isolation strips and washers as part of engineered isolation wall system indicated on Drawings.
      a. Manufacturer/Products: Subject to compliance with requirements, provide one of the following:
         1) Kinetics Noise Control, “Wallmat Stud Isolation Strip”; www.kineticsnoise.com
         2) CMS Danskin Acoustics, “Regupol Strips”; www.cmsdanskin.com.uk
         3) Or approved equal.

I. Floor Ties:
   1. Provide floor ties at half-walls and as recommended by manufacturers to prevent wall deflection.
      a. ASTM A1003/A1003M Structural Grade 50, Type H, ST50H, with 50 ksi min yield strength and 65 ksi minimum tensile strength with ASTM A653/A653M galvanized coating.
         1) The Steel Network: Stiffclip CL.
         2) Or approved equal.

2.12 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), non-perforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

2.13 PARTITION GAP CLOSURE ACCESSORIES

A. Adjustable, insulated metal closures for installation between gypsum board walls and curtain wall or window mullions.

B. Where indicated on drawings, install the following where indicated:
   1. Mullion Mate: Series 60
   2. Or approved equal.

C. Color: To be selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840 A.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   1. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces, unless otherwise indicated.
   2. Type C: Where required for specific fire-resistance-rated assembly indicated.
   3. Flexible Type: Apply in double layer at curved assemblies.
   4. Abuse-Resistant Type: As indicated on Drawings.
   5. High-Impact Type: As indicated on Drawings.
   6. Moisture and Mold-Resistant Type: As indicated on Drawings.

B. Rated Assemblies:

1. Install all rated assemblies in accordance with rated assemblies indicated on Drawings.

C. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Double Layer Application:
   1. Place first layer parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

E. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
   2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.04 APPLYING EXTERIOR GYPSUM SHEATHING

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion-resistant screws.

3.05 APPLYING TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: Install at locations indicated on drawings. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install where indicated on drawings. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Cementitious Backer Units: Per ANSI A108.11, Comply with manufacturer's written installation instructions and install where indicated on drawings.

D. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except where indicated to receive water-resistant panels.

E. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.06 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. Bullnose Bead: Use where indicated.
   3. LC-Bead: Use at exposed panel edges.

4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

3.07 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Panels that are exposed to view in Back of House areas.
4. Level 4: At panel surfaces that will be exposed to view in member facing, unless otherwise indicated.
a. Primer and its application to surfaces are specified in other Division 9 Sections.
5. Level 5: Where Indicated.
a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.08 FRAMING INSTALLATION, GENERAL

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.09 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with locations of hangers required to support standard suspension system members,

install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, 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. Do not attach hangers to steel roof deck.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.10 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.
   1. Space studs as follows:
      a. Single-Layer Application: 24 inches (610 mm) o.c., unless otherwise indicated.
      b. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb, unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   6. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Direct Furring:
   1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:
   1. Erect insulation (specified in 07 21 00 Thermal Insulation) vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

3.11 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 21 17
GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Shaft-wall enclosures.
   2. Chase enclosures.
   3. Stair enclosures.
   4. Horizontal enclosures.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 05 12 00 - Structural Steel Framing.

F. Section 05 21 00 - Steel Joist Framing.

G. Section 05 31 00 - Steel Decking.

H. Section 06 10 00 - Rough Carpentry.

I. Section 07 81 00 - Applied Fireproofing.

J. Section 07 84 00 - Firestopping.

K. Section 07 92 00 - Joint Sealants.

L. Section 08 31 13 - Access Doors and Frames.

M. Section 09 21 16 - Gypsum Board Assemblies.

N. Division 21-28.

1.03 REFERENCE STANDARDS

A. AISI American Iron and Steel Institute; LRFD Design Manual.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

E. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

J. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.04 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

B. Procurement:

1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Provide Materials complying with the requirements of ASTM C1396/C1396M. See Section 09 21 16.

C. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E119 by testing and inspecting agency.

D. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested per ASTM E90 and classified per ASTM E413 by testing and inspecting agency.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
1. American Gypsum Company.
2. CertainTeed Corp.
3. G-P Gypsum.
4. National Gypsum Company.
5. USG Corporation.

2.02 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

2.03 PANEL PRODUCTS

A. Gypsum Liner Panels: Comply with ASTM C1396/C1396M.
1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
a. Core: 1 inch (25 mm) thick.
b. Long Edges: Double bevel.

B. Gypsum Board: As specified in Section 09 21 16 - Gypsum Board Assemblies.

2.04 NON-LOAD-BEARING STEEL FRAMING

A. Non-load bearing steel framing is specified in Section 09 21 16 - Gypsum Board Assemblies.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 09 21 16 - Gypsum Board Assemblies that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Board Joint-Treatment Materials: As specified in Section 09 21 16 - Gypsum Board Assemblies.

D. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

E. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

F. Sound Attenuation Blankets: ASTM C665, Type I, as specified in Section 09 21 16 - Gypsum Board Assemblies.

G. Acoustical Sealant: As specified in Section 07 92 00 - Joint Sealants.

2.06 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
   1. Depth: As indicated.
   2. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

D. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
   1. Minimum Base-Metal Thickness: Matching steel studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure 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.
   1. Subject to compliance with requirements, provide one of the following:
      a. The System by Metal-Lite, Inc.
      b. Fire Trak Corp.; Fire Trak.

F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.

G. Room-Side Finish: As indicated.

H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

I. Insulation: Sound attenuation blankets where indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
   1. ASTM C754 for installing steel framing except comply with framing spacing indicated.
   2. As specified in 09 21 16 - Gypsum Board Assemblies for applying and finishing panels.

B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies 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 shaft-wall assembly framing.
   1. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
   2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312 inch (0.79 mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum board face-layer panel.

D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall 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.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints per ASTM C840 A and in specific locations approved by Architect or indicated on Drawings, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other Work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C919 requirements or with manufacturer's written instructions, whichever are more stringent.

I. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches (102 mm) of shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2 or 5/8 inch (13 or 16 mm) thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).
   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 inches (610 mm) on center with screws fastened to shaft-wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) on center and extend studs from the projection to shaft-wall framing.

J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.02 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include discoloration, sagging, and irregular shape.
   2. Indications that panels are mold damaged include fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Tile:
      a. Porcelain/Ceramic tile.
      b. Glass tile.
      c. Stone tile.
      d. Pool tile, Pool Accent tile, Nosing and Coping.
      e. Stone Base.
   2. Interior Tile Application:
      a. Mortar floor sloping.
      b. Crack isolation membrane.
      c. Setting Materials.
      d. Grout Materials.
      e. Miscellaneous Materials.
         1) Trowelable Underlayments.
         2) Metal edge strips.
         3) Tile Cleaner.
         4) Grout Sealer.
         5) Stone tile Sealer/enhancer.
      f. Waterproof System.
         1) Waterproof Membrane.
            (a) Membrane Components.
            (b) Accessories.
   3. Exterior Tile Application:
      a. Setting Materials.
      b. Grout Materials.

1.02 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 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. Wet Areas: Any area where waterproofing is installed. See key plan on Drawings.

1.03 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete.

F. Section 04 20 00 - Unit Masonry.

G. Section 06 10 00 - Rough Carpentry.

H. Section 07 92 00 - Joint Sealants.

I. Section 09 21 16 - Gypsum Board Assemblies.

J. Section 09 30 01 - Tiling Schedules.

K. Section 13 11 15 - Swimming Pool Finishes.

L. Section 22 13 19 - Sanitary Waste Piping Specialties.

M. Section 26 27 26 - Wiring Devices. Coordinate color of wiring devices with the work of this Section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ADAAG - Americans With Disabilities Act Accessibility Guidelines; 2010.

C. ANSI A108.01 - General Requirements: Subsurfaces and Preparations by Other Trades; 2021a.

D. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.

E. ANSI A108.02 - General Requirements: Workmanship for Tile Installation; 2023.

F. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).

G. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.

H. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

I. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.

J. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

K. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2017 (Reaffirmed 2022).

L. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

M. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.

N. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

O. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

P. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

Q. ASTM C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste; 2020.

R. ASTM C627 - Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester; 2018.

S. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

T. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

U. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007.

V. ASTM C1708/C1708M - Standard Test Methods for Self-Leveling Mortars Containing Hydraulic Cements; 2023.

W. ASTM D5957 - Standard Guide for Flood Testing Horizontal Waterproofing Installations; Current Edition.

X. ASTM D7877 - Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes; 2024.

Y. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Z. ISO 13007-2 - Ceramic Tiles - Grouts and Adhesives - Part 2: Test Methods for Adhesives; 2013.

AA. ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories; 2017.

BB. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

B. Source Limitations for Setting Materials and Accessories: Obtain product of a uniform quality for each application condition from a single manufacturer.

C. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C1028 and:
   1. Level Surfaces: Accessible Routes as defined by ADAAG, Minimum 0.5 static coefficient of friction.
   2. Step Treads: Accessible Routes as defined by ADAAG, Minimum 0.5 static coefficient of friction.
   3. Ramp Surfaces: Accessible Ramps as defined by ADAAG, Minimum 0.8 static coefficient of friction.

D. Preinstallation Conference: Conduct conference at the Project site.
   1. Convene one week prior to commencing work of this section.
   2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.
   3. Meeting agenda includes but is not limited to:
      a. Surface preparation.
      b. Tile and installation material compatibility.
      c. Edge protection, transition and pre-fabricated movement joint profiles.
      d. Waterproofing techniques.
      e. Crack isolation techniques.
      f. Flood testing techniques.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

C. Quantity Take-offs:
   1. Submit material quantity take offs for all material types.

D. Mock-Up:
   1. Tile: Provide a mock-up for evaluation of surface preparation techniques and application quality of work.
      a. Finish areas designated by Architect.
      b. Do not proceed with remaining work until mock up is approved by Architect.
      c. Refinish mock-up area as required to produce acceptable work.
      d. Mock up may be used as part of finished work.
   2. Waterproofing Provide mock-up of each waterproofing system.
      a. Steam Room: (Sheet applied)
         1) Mock up to consist of 1 shower stall, including drain, pipe penetration, wall to wall and wall to floor transitions.
         2) Show materials 'cut away' such that each layer of the assembly are exposed to view.
         3) Include all applicable materials of the assembly.

b. General application: (Fluid applied)
   1) Mock up to consist of a 4' x 4' x 4' minimum area. Include a bottom corner, with transitions between wall to wall and wall to floor, and bench.
   2) Show materials 'cut away' such that each layer of the assembly are exposed to view.
   3) Include all applicable materials of the assembly.
c. Do not proceed with work until mock up is approved by Architect.
d. Refinish mock-up area as required to produce acceptable work.
e. Mock-up may be incorporated into finished work.
f. Tile included as part of a system mock-up may serve as the required tile mock-up.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Executed Warranty.
   1. See below.

1.07 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. Protect waterproofing, grout and mortar materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

F. 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.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile or waterproofing materials until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.09 WARRANTY

A. Provide manufacturer's standard warranty for each tile.

B. The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period as determined by local or project requirements. The manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written twenty five (25) year warranty, which covers materials and labor - reference LATICRETE Warranty Data Sheet 025.0 for complete details and requirements. Single source manufacture.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

A. Tile:
   1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA (HB) installation methods specified in tile installation schedules, and other requirements specified.

3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   a. Where tile is indicated for installation in swimming pools on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
6. At Pool Shower Wall and all outside corners / drains where tile cut edge is exposed. To be wet saw cut mechanically sanded, polished and profiled as not to be sharp. Ease edge smooth to touch.

2.02 PORCELAIN/CERAMIC TILE

A. See attached Schedule.

2.03 GLASS TILE

A. See attached Schedule.

2.04 STONE TILE

A. See attached Schedule.

2.05 STONE BASE

A. See attached Schedule.

2.06 WATERPROOF SYSTEMS

A. Fluid Applied Membrane System:
   1. General Application: Waterproofing and Crack Isolation Membrane to be thin, cold applied, single component liquid and load bearing and UL GREENGUARD Gold certified. Reinforcing fabric to be non-woven rot-proof specifically intended for waterproofing membrane. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured with ANSI A118.10 and ANSI A118.12; ASTM C627.
      a. LATICRETE International, Inc.; HYDRO BAN®.
   2. Steam application: Waterproofing Sheet Membrane to be thin, durable polyethylene core with a fused non-woven polypropylene exterior surface, IAPMO (UPC) approved as shower pan liner, and allow for use of either polymer modified or un-modified tile mortars, depending upon substrate and type of tile used. ANSI 118.10, ASTM C627.
      a. LATICRETE International, Inc.; HYDRO BAN Sheet Membrane®.
      b. Accessories: Pipe & Corner reinforcement; LATICRETE International, Inc.; HYDRO BAN Sheet Membrane® Corners & Pipe Collars as recommended by manufacturer.
   3. Tile Setting Materials: Latex-Portland Cement Mortar: (Inside Pool Shell (non-stainless steel)
      a. LATICRETE International, Inc. 254 Platinum®, Exceeds ANSI ANSI A118.4, ANSI A118.11, & ANSI A118.15.
      b. LATICRETE International, Inc. 254R Platinum Rapid (Rapid Set Mortar when specified) ANSI A118.11.
   4. Epoxy Adhesive:
      a. LATICRETE International, Inc. LATAPOXY® 300 Adhesive (Epoxy Adhesive, Suitable steel substrates when specified) ANSI A118.3
   5. See below for grout materials.

2.07 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Membrane strips must cover three (3) times the width of the floor tile used, with a minimum width of 36 inches.
   1. Crack Isolation and Waterproof Membrane: Waterproofing and anti-fracture/crack suppression membrane.
      a. LATICRETE International, Inc; HYDRO BAN®.

2.08 MORTAR BED MATERIALS

A. Pre-Blended, Polymer-Modified, Cement-Based, Sloping Mortar.
   1. LATICRETE International, Inc.; 3701 Fortified Mortar or 3701 LITE Fortified Mortar.

B. Quick Setting, Polymer Modified, Fiber-Reinforced, Cementitious Rendering, Patching and Leveling Mortar.
   1. LATICRETE International, Inc.; 3701 Lite Mortar R.

2.09 SELF-LEVELING UNDERLAYMENT

A. High quality, fiber reinforced, cement-based, self leveling underlayment for use in leveling suitable interior substrates. For large format tile as identified by TCNA, or as specified. 5300 psi (36.5 MPa) (ASTM C1708/C1708M 28 days)
   1. LATICRETE International, Inc; NXT Level Plus with NXT Primer.

2.10 SETTING MATERIALS

A. Improved Modified, Dry-Set Portland Cement Mortar (Thin-Set,): ANSI A118.15.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Except in connection with the Waterproof systems specified herein.)
      a. LATICRETE International, Inc.; MULTIMAX LITE®

2.11 GROUT MATERIALS

A. Premium Epoxy Mortar and Grout: (Wet Areas: Floors, Walls, Ceilings) For grout joints from 1/16 inch to 1/2" ANSI A118.3, ISO 13007-2 R2 and RG, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
   1. Product: Subject to compliance with requirements, provide the following:
      a. LATICRETE International, Inc; SPECTRALOCK PRO PREMIUM®

B. High Performance, Polymer-Modified Tile Grout: (Non-Wet Area Walls) ANSI A118.7.
   1. Manufacturers: Subject to compliance with requirements, provide products of the following:
      a. LATICRETE International, Inc.; PERMACOLOR ®

C. Flexible Sealant: Professional-grade, 100%-silicone sealant specifically formulated for heavy traffic expansion and movement joints, horizontal and vertical complying with ASTM standards; joint movement (ASTM C920), adhesion (ASTM C794) and passes weatherability (Accelerated Weathering Tester QUV), Shore A hardness (27).
   1. Product: Subject to compliance with requirements, provide the following:
      a. LATICRETE International, Inc.; LATASIL™

2.12 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
   1. Product: Subject to compliance with requirements, provide the following:
      a. LATICRETE International, Inc., NXT Skim Lite.
      b. LATICRETE International, Inc., NXT Patch.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications.
   1. See Attached Schedule.

C. Custom Transitions:

1. Sloped Mortar:
    a. Description: Mortar slope to achieve flush transition between tile and another floor material.
    b. Material and Finish: See drawings.
    c. Height: As required.
    d. Location: See drawings.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
1. Product: Subject to compliance with requirements, provide the following:
    a. LATICRETE International, Inc.; STONETECH® Stone & Tile Cleaner (Concentrate) Daily.
    b. LATICRETE International, Inc.; STONETECH® Klenzall Cleaner (Concentrate) Deep Clean.

E. Grout Sealer: Premium, water based penetrating sealer, for sealing grout joints and that does not change color or appearance of grout.
1. Product: Subject to compliance with requirements, provide the following:
    a. LATICRETE International, Inc; STONETECH® BulletProof.

F. Flexible Sealant: Professional-grade, 100%-silicone sealant specifically formulated for heavy traffic expansion and movement joints, horizontal and vertical complying with ASTM standards; shore A hardness (27), joint movement (ASTM C920), adhesion (ASTM C794) and passes weatherability (Accelerated Weathering Tester QUV).
1. Product: Subject to compliance with requirements, provide the following:
    a. LATICRETE International, Inc., LATASIL.

G. Stone Tile Sealer/Enhancer: Solvent based, penetrating sealer formulated to prevent oil and water based staining to stone while not changing the surface's appearance or finish. To be used on indicated Stone Tile only, see schedule.
1. Product: Subject to compliance with requirements, provide the following:
    a. Laticrete, Stonetech Bulletproof Sealer.

2.13 EXTERIOR APPLICATION

A. General: Where exterior tile installation is indicated, provide products recommended by their manufacturers for the application.

B. Exterior Wall and Soffit application:
1. Backing material: As indicated on drawings and approved for tile application by its manufacturer and Laticrete.
2. Polymer-Modified Mortar.
    a. One-component, polymer fiber reinforced veneer mortar, to meet or exceed ASTM C270 compressive strength requirements and IBC ASTM C482 Shear bond strength requirements, and ANSI A118.4 for adhered stone and tile.
    b. For use to adhere exterior thin masonry units as shown on drawings.
        1) Exposed joints shall use Cementitious Mortar above.
    c. Manufacturers and Products:
        1) Basis of Design: Laticrete MVIS Veneer Mortar.
        2) Or approved equal.
    d. Water: Potable.
3. High Performance, Polymer-Modified Tile Grout: ANSI A118.7.
    a. Manufacturers: Subject to compliance with requirements, provide products of the following:
        1) LATICRETE International, Inc.; PERMACOLOR ®

C. Exterior Floor application:
1. Quick Setting, Polymer Modified, Fiber-Reinforced, Cementitious Rendering, Patching and Leveling Mortar.
    a. LATICRETE International, Inc.; 3701 Lite Mortar R.
2. High Performance, Polymer-Modified Tile Grout: ANSI A118.7.
    a. Manufacturers: Subject to compliance with requirements, provide products of the following:

1) LATICRETE International, Inc.; PERMACOLOR ®

D. Expansion Joint:
1. Stainless Steel profile as detailed.
2. Install as shown on drawings and recommended by tile Manufacturer.

PART 3 EXECUTION

3.01 SYSTEMS

A. Provide Waterproof system components only where indicated on Drawings.

B. At Waterproof systems, do not begin tiling work until flood test(s) have been performed.

3.02 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. 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.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1a and is sloped 1/4 inch per foot (1:50) toward drains. All waterproofing to be sloped to drains.

C. All recessed areas sloped / apply waterproofing. Bead elastomeric caulk at all drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.04 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

C. Testing:
1. Perform ELD (Electronic Leak Detection) test of vertically applied waterproof membrane to ensure that it attains specified resistance to moisture penetration.
a. Testing to be performed according to the requirements of ASTM D7877 by ISO/IEC 17025 certified personnel.
b. Patch or replace failed areas as recommended by manufacturer.
2. Perform Flood testing of all waterproofing systems.

a. Perform test according to ASTM D5957.
b. Examine all adjacent areas and areas below for signs of water leakage.
c. If leakage is detected, demolish and replace waterproof membrane.
d. Do not proceed with work until flood tests are passed.

3.05 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ASTM A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.06 TILE INSTALLATION

A. Comply with TCNA's "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. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Tile setting:
1. All tile installed over a waterproof system to be 90% min bonded to substrate. Do not allow voids behind tiles in wet areas.
2. Slope setting materials in waterproofed areas to drains.
a. Cut large format tile if necessary to slope to drain.
b. Do not install a drain within a large format tile without proper sloping.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Provide 3/16; expansion joints in Pool Deck: locate expansion joints at perimeter of Lap and Leisure pools; aligned with saw/control joints in concrete throughout the entire pool deck. See movement joint layout on Floor Finish Drawings.
3. Install expansion and control joints in accordance with TCNA method EJ171.

H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
1. Fill metal edge strips and coves in wet areas with grout.

I. Mortar and Grout Curing:
1. Allow Mortar and Grout to cure for the minimum duration recommended by manufacturer before proceeding.

2. Ensure temperature and humidity are within required range during this period.

J. Grout Sealer: Apply grout sealer to cementitious grout joints 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.

K. Exterior Application:
1. Wet bonding surfaces of tile thoroughly prior to installation in dry climates.
2. See Section 04 20 00 for more information.

3.07 STONE TILE SEALER APPLICATION

A. Apply only to scheduled materials, see schedule.

B. Apply according to Manufacturer's instructions.

C. Do not apply multiple coats.

D. Wipe away excess sealer before it dries.

E. Protect surface during drying period.
1. See manufacturer's instructions.

3.08 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. 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. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for the time period recommended by manufacturer for the grouting material and conditions.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09 30 01
TILING - SCHEDULES

GROUT

1.01 LATICRETE SPECTRALOCK PRO PREMIUM

A. Color: as specified per tile type.

B. Location:
   1. Vanity area - Floors.
   2. Showers - Floors, walls, ceilings.
   3. Wet Suites - Floors, walls.
   4. Steam rooms - Floors, walls, ceilings.
   5. Sauna - Floors.
   6. Family Locker - Floors.
   7. Family Changing Rooms - Floors, walls, ceilings.
   8. Pool Restrooms - Floors, walls, ceilings.
   9. Pool - Grip at edge of pool and all tiled surfaces interior of vessel - waterline, steps, nosing, benches, lane lines and markers, etc.

1.02 LATICRETE PERMACOLOR

A. Color: As specified per tile type.

B. Location: All other locations not listed above for Spectralock; general tile walls, floors, ceilings.

PORCELAIN/CERAMIC TILE

2.01 TL-15A

A. Distributor: Kate-Lo

B. Manufacturer: Olympia Tile

C. Series: Rock

D. Color: Brown

E. Finish: Matte, Natural

F. Size: 12" x 24"

G. Code: OL.RK.BWN.1224.N

H. Joint Width: 1/8”

I. Grout: Laticrete CLR #35 Mocha

J. Location: Walls Exterior Bistro

K. Installation: Straight Stacked

L. Contact: Jennifer Bohlinger, (763) 232-6531, jennifer@katelotile.com

2.02 TL-22A

A. Manufacturer: Daltile

B. Series: Society

C. Color: Civic Sand S046

D. Finish: Unpolished

E. Size: 12" x 24"

F. Joint Width: 1/8"

G. Grout: Laticrete CLR #17 Marble Beige

H. Location: Cafe/Bar and Walls-Yoga

I. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

J. URL: https://www.daltile.com/product/Society?color=Civic-Sand&shape=Rectangle

2.03 TL-30Z

A. Manufacturer: Wow Tile
B. Distributer: Virginia Tile
C. Collection: Odyssey
D. Color: Green
E. Finish: Matte
F. Product Number: VTLOYGN216M
G. Size: 2" x 16"
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #60 Dusty Grey
J. Location: Walls
K. Installation: Stacked
L. Note: Flat Version
M. Contact: Cristin Hennessy, 612-801-6758, Cristin.Hennessy@VirginiaTile.com
N. Lead Time: Allow 8-10 weeks
O. URL: https://www.wowdesigneu.com/collection/faces/

2.04 TL-31S

A. Manufacturer: Daltile
B. Distributer: Daltile
C. Series: Sleigh Creek
D. Color: Carriage SK32
E. Finish: Matte
F. Size: 6” x 36”
G. Joint Width: 1/16”
H. Grout: Laticrete CLR #35 Mocha
I. Installation: Third Offset
J. Location: Cafe Floors, Base at Member side of Cafe Service Line
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728
L. URL: https://www.daltile.com/products/Wood-Look/Sleigh-Creek/Carriage

2.05 TL-32BB

A. Vendor: Virginia Tile
B. Manufacturer: VITL
C. Series: Cityscape
D. Size: 1.5" x 4.6"
E. Color: Light Blue
F. Finish: Gloss
G. Sku: VTLCOLB25G
H. Grout: Laticrete CLR #09 Frosty
I. Installation: Stacked
J. Location: Spa Waterline

K. Contact: Cristin Hennessy 612-801-6758

L. URL: https://lunadabaytile.com/collections/origami-mosaic/products/vesper?variant=41453365526681

2.06 TL-51BP

A. Distributer: Virginia Tile

B. Manufacturer: VITL

C. Series: Camilla

D. Color: Beige

E. Finish: Polished

F. Size: 24" x 24", Rectified

G. Code: VTLCABE2424P

H. Joint Width: 1/8”

I. Grout: Laticrete CLR #17 Marble Beige

J. Installation: Straight Stacked

K. Location: Walls - Locker Rooms

L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

M. URL: https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.07 TL-51LP

A. Distributer: Virginia Tile

B. Manufacturer: VITL

C. Series: Camilla

D. Color: Beige

E. Finish: Polished

F. Size: 24” x 48” Rectified

G. Code: VTLCABE2448P

H. Joint Width: 1/8”

I. Grout: Laticrete CLR #17 Marble Beige

J. Installation: Straight Stacked

K. Location: Walls

L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

M. URL: https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.08 TL-52A

A. Distributer: Virginia Tile

B. Manufacturer: VITL

C. Series: Camilla

D. Color: Brown

E. Finish: Matte

F. Size: 12" x 24", Rectified

G. Code: VTLCABR1224R

H. Joint Width: 1/8”

I. Grout: Laticrete CLR #27 Hemp
J. Installation: Third Offset
K. Location: Floors- Locker Bay
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com
M. URL: https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.09 TL-52F

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Camilla
D. Color: Brown
E. Finish: Matte
F. Size: 4" x 24" Installer to cut on site from 12” x 24” (TL-52A)
G. Code: VTLCABR1224R
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #27 Hemp
J. Installation: Straight Stacked
K. Location: Locker Bay Base
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com
M. URL: https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.10 TL-52LP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Camilla
D. Color: Brown
E. Finish: Polished
F. Size: 24” x 48”
G. Code: VTLCABR2448P
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #27 Hemp
J. Installation: Straight Stacked
K. Location: Café
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com
M. URL: https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.11 TL-52MP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Camilla
D. Color: Brown
E. Finish: Polished

F. Size: 1 1/4" x 1 1/4", Mosaic
G. Code: VTLCABRMOS11P
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #27 Hemp
J. Installation: Straight Stacked
K. Location: Locker Room Accent
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com
M. URL:https://url.usb.m.mimecastprotect.com/s/xpr4C0AjgrHWXLOYIwf2c9uVqx?domain=virginiatile.com/

2.12 TL-53B

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Pulpis
D. Color: Brown
E. Finish: Matte
F. Size: 24" x 24"
G. Code: LTFTL532424R
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #35 Mocha
J. Installation: See Plans
K. Location: Circulation, Reception, Locker Room walkways
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.13 TL-53CG

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Pulpis
D. Color: Brown
E. Finish: Grip
F. Size: 4" x 8"
G. Code: LTFTL5348G
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #35 Mocha
J. Installation: Half Offset
K. Location: Locker Room Shower and Vanity Floors
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.14 TL-53F

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Pulpis
D. Color: Brown
E. Finish: Polished

F. Size: 4" x 24" (cut on site from 24" x 24" TL-53B)
G. Code: LTFTL532424R
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #35 Mocha
J. Installation: Stacked
K. Location: Base - See finish plans
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.15 TL-53H

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Pulpis
D. Color: Brown
E. Finish: Matte
F. Size: 6" x 24" (cut on site from 24" x 24" TL-53B)
G. Code: LTFTL532424R
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #35 Mocha
J. Installation: Stacked
K. Location: Base at Family Locker
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.16 TL-53MP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Pulpis
D. Color: Brown
E. Finish: Polished
F. Size: 1 1/4" x 1 1/4", Mosaic
G. Code: LTFTL53MOS11P
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #35 Mocha
J. Installation: Stacked
K. Location: Locker room borders
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.17 TL-55BP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Ourmani
D. Color: Gray
E. Finish: Polished
F. Size: 24" x 24"
G. Code: LTFTL552424P

H. Joint Width: 1/8”
I. Grout: Laticrete CLR #60 Dusty Gray
J. Installation: Stacked
K. Location:Wet Suite Ceiling
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.18 TL-55LP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Ourmani
D. Color: Gray
E. Finish: Polished
F. Size: 24" x 48"
G. Code: LTFTL552448P
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #60 Dusty Gray
J. Installation: Stacked
K. Location:Cafe, Wet Suite, Mens and Womens Shower Focal Walls
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.19 TL-61A

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Parchment
D. Color: Beige
E. Finish: Matte/Textured
F. Size: 12" x 24"
G. Code: LTFTL611224
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #17 Marble Beige
J. Installation: Stacked, See finish plans and elevations
K. Location: Studio Portals, Kids Entry Floor, Kids Restroom floor and wall,Steam Room walls, ceilings, and benches
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.20 TL-61AG

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Parchment
D. Color: Beige
E. Finish: Grip
F. Size: 12" x 24"
G. Code: LTFTL611224G
H. Joint Width: 1/8”

I. Grout: Laticrete CLR #17 Marble Beige
J. Installation: Stacked
K. Location: Wet Suite Floors, Steam and Sauna Floors
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.21 TL-61F

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Parchment
D. Color: Beige
E. Finish: Matte
F. Size: 4" x 24" (cut on site from 12" x 24" TL-61A)
G. Code: LTFTL611224
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #17 Marble Beige
J. Installation: Stacked, See finish plans and elevations
K. Location: Salon base, LT Kid's Entry and Restroom base.
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.22 TL-61T

A. Manufacturer: VITL
B. Series: Parchment
C. Color: Beige
D. Finish: Matte
E. Size: 3" x 24" Bullnose Trim
F. Code: LTFTL61BN324
G. Joint Width: 1/8”
H. Grout: Laticrete CLR #60 Dusty Gray
I. Installation: Stacked
J. Location: Warm Spa and Cold Plunge trim
K. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.23 TL-62B

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Gaia
D. Color: Black
E. Finish: Matte
F. Size: 24" x 24"
G. Code: VTCGEBK2424
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #45 Raven
J. Installation: Stacked
K. Location: Wet Suite

L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.24 TL-62T

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Gaia
D. Color: Black
E. Finish: Matte
F. Size: 3" x 24" Bullnose Trim
G. Code: VTCGEBKBN324
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #45 Raven
J. Installation: Stacked
K. Location: Stair nosing up to Warm Spa and Cold Plunge, Steam Room benches
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

2.25 TL-77LP

A. Distributer: Virginia Tile
B. Manufacturer: VITL
C. Series: Alexandria
D. Color: Beige
E. Finish: Polished
F. Size: 24" x 48"
G. Code: VTLAXBE2448PN
H. Joint Width: 1/8”
I. Grout: Laticrete CLR #93 Fossil
J. Installation: Stacked
K. Location: See Drawings
L. Contact: Cristin Hennessy Cristin.Hennessy@VirginiaTile.com

GLASS TILE

3.01 GT-51

A. Vendor: Virginia Tile
B. Manufacturer: Lunada Bay Tile
C. Series: Origami Mosaic
D. Size: Vesper
E. Color: Bari
F. Finish: Pearl
G. Sku: ORG-VESPER-BARI-PRL
H. Grout: Laticrete #09 Frosty
I. Location: See Drawings.
J. Contact: Cristin Hennessy 612-801-6758
K. URL: https://lunadabaytile.com/collections/origami-mosaic/products/vesper?variant=41453365526681

3.02 GT-51A

A. Vendor: Virginia Tile
B. Manufacturer: Lunada Bay Tile
C. Series: Origami Mosaic
D. Size: Vesper Twist
E. Color: Bari
F. Finish: Pearl/Silk
G. Sku: LUNORBRVESTWIST
H. Grout: Laticrete #09 Frosty
I. Location: Locker Room Accent Wall.
J. Installation: Stacked V
K. Contact: Cristin Hennessy 612-801-6758
L. URL: https://lunadabaytile.com/collections/origami-mosaic/products/vesper-twist?variant=41453366116505

3.03 GT-52

A. Vendor: Virginia Tile
B. Manufacturer: Lunada Bay Tile
C. Series: Agate
D. Size: Martini
E. Color: Bari
F. Finish: Pearl
G. Sku: SW-AGT-MART-BARI-PRL
H. Grout: Laticrete #09 Frosty
I. Location: Locker Room Focal Wall
J. Contact: Cristin Hennessy 612-801-6758
K. URL: https://lunadabaytile.com/collections/agate/products/martini?variant=41427774570649

POOL TILE, POOL ACCENT TILE, POOL NOSING AND POOL COPING

4.01 1X1 PROFILES AVAILABLE

A. See https://www.daltile.com/products/mosaic/keystones for further details
B. S862 (Bullnose)
C. SC862 (Bullnose Corner)
D. C813 (Cove Base)
E. CB813 (Cove Base Corner for 2x2 Thinset or Conventional Mortar corners)
F. CK813 (Cove Base Corner for 1x1 Thinset or Conventional Mortar corners)
G. S812 (Universal Trim – rounded edge)

4.02 2X2 PROFILES AVAILABLE

A. See https://www.daltile.com/products/mosaic/keystones for further details
B. S886 (Bullnose)
C. SC886 (Bullnose Corner)
D. C833 (Cove Base)
E. SB816 (Cove Base In-Corner)

F. S832 (Universal Trim – rounded edge)
G. SC813 (Cove Base Out-corner for 1x1 or 2x2 cove corners)
H. C701 (Universal Trim – grip edge)

4.03 PC-6:

A. Manufacturer: Buchtal
B. Distributer: Knox Tile
C. Profile (Hand Hold): #55730
D. Profile (Internal Corner): #55732
E. Profile (External Corner): #55736
F. Color: 553001 Blue Active Azure Strip/Grey Beige Body.
G. Finish: Non-slip grip finish.
H. Module Size: 4 3/4" W x 9 5/8" L x 1" D
I. Joint Width: 1/8"
J. Grout above waterline: Laticrete Spectralock + Grout Maximizer CLR #17 Marble Beige
K. Grout below waterline: Laticrete Spectralock + Grout Maximizer CLR #17 Marble Beige
L. Location: Coping at outdoor pools in cold climates.

4.04 TL-101M2

A. Manufacturer: Daltile
B. Pattern: Keystone Mosaics
C. Color: Castle Rock D618
D. Finish: Matte, unglazed
E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Laticrete CLR #60 Dusty Grey
I. Locations: Indoor warm spa and cold plunge bench/stair contrasting trim
J. Profiles:
    1. S886 (Bullnose)
    2. SC886 (Bullnose Corner)
    3. C701 (Universal Trim)
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728
L. URL: https://www.daltile.com/product/Keystones?color=Castlerock&shape=Straight%20Joint

4.05 TL-102M2

A. Manufacturer: Daltile
B. Pattern: Keystone Mosaics
C. Color: Nautical Blue D621
D. Finish: Matte, unglazed
E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Laticrete CLR #44 Bright White

I. Location: Lap pool lane lines, targets and outdoor stair nosing.

J. Profiles:
1. 2" x 2"
2. S886 (Bullnose)
3. SC886 (Bullnose Corner)

K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

L. URL: https://www.daltile.com/product/Keystones?color=Nautical-Blue&shape=Straight%20Joint

4.06 TL-103M2

A. Manufacturer: Daltile

B. Pattern: Keystone Mosaics

C. Color: Arctic White D617

D. Finish: Matte, unglazed

E. Module Size: 2” x 2”

F. Nominal Tile Thickness: 1/4 inch

G. Joint Width: 1/8 inch

H. Grout: Laticrete CLR #44 Bright White

I. Location: Tile trim below waterline at indoor/outdoor lap or leisure pools where universal trim grip edge occurs.

J. Profiles:
1. 2" x 2"

K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

L. URL: https://www.daltile.com/product/Keystones?shape=Straight%20Joint&color=Arctic-White

4.07 TL-103M2G

A. Manufacturer: Daltile

B. Pattern: Keystone Mosaics

C. Color: Arctic White D617

D. Finish: Abrasive

E. Module Size: 2” x 2”

F. Nominal Tile Thickness: 1/4 inch

G. Joint Width: 1/8 inch

H. Grout: Laticrete #44 Bright White

I. Location: Tiled treads of warm spas, cold spas and outdoor pool stairs – water side, Tiled band at leisure pool zero depth entry.

J. Profiles:
1. 2” x 2”

K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

L. URL: https://www.daltile.com/product/Keystones?shape=Straight%20Joint&color=Arctic-White

4.08 TL-104M2G

A. Manufacturer: Daltile

B. Pattern: Keystone Mosaics

C. Color: Artisan Brown D144

D. Finish: Abrasive

E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Laticrete CLR #57 Hot Cocoa
I. Location: For use only when filed tile DCOF must exceed 0.42
J. Profiles:
    1. 2x2 tile
    2. S886 (Bullnose)
    3. SC886 (Bullnose Corner)
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728
L. URL: https://www.daltile.com/product/Keystones?shape=Straight%20Joint&color=Arctic-White

4.09 TL-105M2

A. Manufacturer: Daltile
B. Pattern: Keystone Mosaics
C. Color: Medium Mottled Brown D050
D. Finish: Matte, unglazed
E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Laticrete CLR #57 Hot Cocoa
I. Location: Field floor tile and cove base trim at indoor pool room, treads at outdoor warm spa
J. Profiles:
    1. 2” x 2”
    2. C833 (Cove Base)
    3. CB813 (Cove Base In-Corner)
    4. SC813 (Cove Base Out-corner for 1x1 or 2x2 cove corners)
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728
L. URL: https://www.daltile.com/product/Keystones?shape=Straight%20Joint&color=Arctic-White

4.10 TL-105M2G

A. Manufacturer: Daltile
B. Pattern: Keystone Mosaics
C. Color: Medium Mottled Brown D050
D. Finish: Abrasive
E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Laticrete CLR #57 Hot Cocoa
I. Location: For use only when field tile DCOF must exceed 0.42
J. Profiles:
    1. 2” x 2”
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728
L. URL: https://www.daltile.com/product/Keystones?shape=Straight%20Joint&color=Arctic-White

4.11 TL-106M2:

A. Manufacturer: Daltile
B. Pattern: Keystone Mosaics
C. Color: Scioto Sand DALD616 (LT Custom)
D. Finish: Matte, unglazed
E. Module Size: 2” x 2”
F. Nominal Tile Thickness: 1/4 inch
G. Joint Width: 1/8 inch
H. Grout: Color to be Selected by Architect
I. Location: Pool
J. Profiles:
    1. 2” x 2”
        a. C833 (Cove Base)
        b. CB813 (Cove Base In-Corner)
        c. SC813 (Cove Base Out-corner for 1x1 or 2x2 cove corners)
K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

STONE TILE

5.01 ST-23:

A. Distributor: Virginia Tile
B. Manufacturer: Island Stone
C. Series: Uniform Cladding
D. Color: Sandstone Mint
E. Finish: Textured (Flamed)
F. Module Size: 15 ½” x 4 ¾”
G. Nominal Tile Thickness: ½ -1”
H. Installation: Butt-jointed
I. Grout: Do NOT grout.
J. Sealer: none.
K. Location: See Drawings
L. Contact: Cristin Hennessy, 612-801-6758, Cristin.Hennessy@VirginiaTile.com
M. URL: https://islandstone.com/collections/all/products/stone-textured-wall-tile-uniform-sandstone-mint-chipped?variant=39580204761271

5.02 ST-34

A. Manufacturer: Daltile
B. Stone Type: Granite, complying with ASTM C615.
C. Color: Absolute Black
D. Finish: Honed
E. Module Size: 12" x 12" (cut to 2" with 1 eased and polished edge)
F. Nominal Tile Thickness: 3/8"
G. Installation: Stacked
H. Grout: Laticrete CLR #60 Dusty Grey
I. Sealer: Stonetech Sealer.

J. Location: Stair nosing

K. Contact: E-mail: Lifetime.fitness@daltile.com, Phone: 877.556.5728

L. URL: https://www.daltile.com/products/Natural-Stone/Granite/Absolute-Black

METAL EDGE STRIPS

6.01 SCHLUTER-JOLLY

A. Manufacturer: Schluter

B. Series: Jolly

C. Description: L-shaped profile with 1/8" (3.2mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg and integrated grout joint spacer.

D. Anchoring Leg:
   1. Provide with straight anchoring leg.
   2. Provide with special radius anchoring leg for radius application.

E. Material and Finish: Aluminum with Brushed Antique Bronze or as selected by architect. Brushed Nickel Anodized Aluminum (ATGB) at corners at TL-1DP/TL-1EP tile pattern.

F. Height: As required

G. Location: Tile Edge protection as indicated on drawings, exposed edges at all TL-5 Series tiles.

6.02 SCHLUTER DILEX-AHK

A. Manufacturer: Schluter

B. Series: DILEX-AHK

C. Description: Anodized aluminum profile with integrated trapezoid-perforated anchoring leg, connected at a 90-degree angle by a cove-shaped section with 3/8" (10mm) radius that forms the visible surface.

D. Corners/End Caps/Connectors: Provide matching units.

E. Material and Finish: Satin Nickel Anodized Aluminum, or as selected by architect.

F. Height: As required.

G. Location: Wet areas throughout.

6.03 SCHLUTER DILEX-EDP

A. Manufacturer: Schluter

B. Series: DILEX-EDP

C. Description: Stainless Steel profile with integrated trapezoid-perforated anchoring legs connected by 15/32" wide tongue and groove joint that forms the visible surface.

D. Corners/End Caps/Connectors: Provide matching units.

E. Material and Finish: E- Stainless Steel type 304 = V2A

F. Location: Exterior Tile expansion joints.

6.04 SCHLUTER DILEX-EKE

A. Manufacturer: Schluter

B. Series: DILEX-EKE

C. Description: Profile with integrated rigid, recycled PVC trapezoid-perforated anchoring legs, connected at a 90-degree angle by a 3/16" (5mm) wide soft CPR movement zone that forms the visible surface.

D. Movement Zone Color: Light Beige

E. Height: As required

F. Location: Steam Room

6.05 SCHLUTER-FINEC

A. Manufacturer: Schluter
B. Series: FINEC
C. Description: Profile with 1/8" (3.5mm) reveal for outside corners of tiled walls, and 135 degree integrated trapezoid-perforated anchoring leg.
D. Corners: Provide with matching outside corners.
E. Material and Finish: As selected by Architect
F. Height: As required
G. Location: Edge protection at Glass Tile locations.

6.06 SCHLUTER-DESIGNLINE

A. Manufacturer: Schluter
B. Series: DESIGNLINE
C. Description: Vertical tile divider. 1" wide
D. Material and Finish: ATGB brushed nickel anodized aluminum or as selected by architect
E. Height: As required. See drawings
F. Location: Grand Stair, see interior details.

6.07 SCHLUTER-RENO RAMP-K

A. Manufacturer: Schluter
B. Series: RENO RAMP-K
C. Description: Material transition
D. Material and Finish: Anodized Aluminum, or as selected by architect
E. Height: As required
F. Location: Transition between tile and concrete

6.08 SCHLUTER-DECO

A. Manufacturer: Schluter
B. Series: -DECO
C. Description: Same height transition.
D. Material and Finish: Solid Brass, or as selected by Architect.
E. Height: As required
F. Location: Transition between tiles, Transition between tile and contrasting stone strip at Grand Stair Nosing.

6.09 SCHLUTER-QUADEC

A. Manufacturer: Schluter
B. Series: QUADEC
C. Description: Edge Protection
D. Material and Finish: As selected by architect
E. Height: As required
F. Location: Edge protection at 1st and 2nd Floor planter, and 3rd Floor columns @ tile

SCHEDULE OF FACEPLATE AND WIRING DEVICES COLORS BY WALL FINISH:

7.01 WHITE FACEPLATES ARE TO BE USED ON WALLS WITH THE FOLLOWING FINISHES:

A. TL-22 (series)

B. TL-51 (series)
C. TL-61 (series)
D. TL-77 (series)

7.02 ALL OTHER FACEPLATES AND WIRING DEVICES INSTALLED ON TILE ARE TO BE BLACK.

END OF SECTION

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SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Acoustical ceiling tiles and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 05 21 00 - Steel Decking.

F. Section 07 92 00 - Joint Sealants.

G. Section 09 21 16 - Gypsum Board Assemblies.

H. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

I. Section 09 51 14 - Acoustic Panel Ceilings Schedule.

J. Section 09 84 30 - Sound Absorbing Wall and Ceiling Units.

K. Section 09 91 00 - Painting.

L. Section 26 27 26 - Wiring Devices. Coordinate color of wiring devices with the work of this Section.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

E. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation; Current Edition, Including All Revisions.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

G. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.

H. ASTM E1190 - Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; Current edition.

I. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. CISCA (AC) - Acoustical Ceilings: Use and Practice; 1999.

L. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

C. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

D. Compliance with referenced ASTM Standards, and if applicable, compliance with requirements for Seismic Design Categories C, D, E, and F.

E. Shop Drawings:
   1. Show layout, spacing, sizes, thicknesses and types of ceiling component, fabrication and fastening and anchorage details, including mechanical fasteners. Show reinforcing clips, hanger wires, compression braces, bracing, runners/channels, angles, splices, accessories, connection details and attachment to adjoining work.
   2. Shop Drawings for components requiring seismic design for Seismic Design Categories C, D, E, and F, signed and certified by an engineer for approval for suspended ceiling components.

F. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

G. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E1264 for Class A materials as determined by testing identical products per ASTM E84.

D. Engineering Responsibility: Preparation of shop drawings, design calculations and other structural data by a qualified professional engineer.

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 cold-formed metal framing that are similar to those indicated for this Project in material, design and extent.

1.06 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 a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical panels 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.

1.09 SYSTEM DESCRIPTION

A. Loading:
   1. Design and size components to withstand gravity and seismic loads in accordance with the building code. See ASCE 7, Chapter 13.

B. See Architectural Drawings Sheet G010 for Seismic Design Category designation.

C. Structural Performance. See ASCE 7, 13.5.6:
   1. IBC/CBC Seismic Categories D, E, F.
      a. Heavy Duty Grid.
      b. Minimum 3/4 inch clearance from grid end to wall.
      c. Minimum 2 inch perimeter molding.
      d. Minimum of 3/4 inch overlap of grid on the wall molding.
      e. Grid must be attached on 2 adjacent walls, no attachment on other 2 walls.
      f. Ends of main beams and cross tees tied together to prevent spreading.
      g. Partition attachment bracing and cable tray and electrical conduit bracing is required to be independent from ceiling splay bracing.
      h. Safety wires required on light fixtures.
      i. Seismic separation joint required for areas greater than 2,500 sq. ft. (or full height partitions).
      j. Rigid bracing required for ceiling elevation changes.
      k. Each area shall be provided with closure angles or channels in accordance with Section 13.5.6.2.2.a and horizontal restraints or bracing.
      l. Interior suspended ceilings, soffits, and bulkheads: Maintain deflection of not more than L/360 of distance between supports.
      m. Perimeter support wires.
      n. Suspended ceilings will be subject to special inspection.

PART 2 PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 5 percent by weight.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-

positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3274 and evaluated according to ASTM D3274 or ASTM G21.

2.02 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. See Attached Schedule.

B. Classification: Provide panels complying with ASTM E1264.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. 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 C635/C635M.

C. Finishes and Colors, General: Comply with NAAMM AMP 500-06 "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.

D. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Powder-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 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 per ASTM E1190, conducted by a qualified testing and inspecting agency.

E. 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 hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-(2.69-mm-) diameter wire.

F. Hanger Rods Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
   1. See Schedule.

B. Capped, Double-Web, Hot-Dip Galvanized, G30 Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according toASTM A653/A653M, G30 coating designation, with prefinished, cold-rolled, aluminum caps on flanges.
   1. See schedule for width.
   2. Structural Classification: See part 1.10 above for requirements.
   3. Face Design: Flat, flush.
   4. Face Finish: White satin. Unless noted otherwise.

C. ACT hold-down clips and related materials.
   1. By Manufacturer.

2.05 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide the following:
   1. See Schedule.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Manufacturer's standard flat wall angle, unless other profile indicated, for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

C. Fasteners: Shall be prefinished or painted white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. 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.

3.03 ACOUSTICAL PANEL CEILING INSTALLATION

A. General: Based on Seismic Design Category, install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, per manufacturer's written instructions and CISCA (AC) "Ceiling Systems Handbook".

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, counter-splaying, 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. 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 or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or powder-actuated fasteners that extend through forms into concrete.
   6. 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.
   7. Do not attach hangers to steel deck tabs.
   8. Do not attach hangers to steel roof deck.
   9. Attach hangers to structural members.
   10. 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.
   11. 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. 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.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   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. Install acoustical panels with undamaged edges and fit 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 as follows:
      a. Install 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.

G. Install acoustical panel hold-down clips at ACT-1 installed in entry vestibule.

3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, suspended decorative grid ceiling systems, including trim, edge moldings, and suspension system members. 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.

END OF SECTION

SECTION 09 51 14
ACOUSTICAL PANEL CEILING - SCHEDULE

ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

1.01 ACT-7

A. Manufacturer: USG Interiors, Inc.; Sheetrock brand Clima Plus Vinyl No. 3260

B. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes

C. Pattern: G (smooth)

D. Color: White

E. LR: Not less than 0.77

F. NRC: Not less than .1

G. CAC: Not less than 35

H. Edge/Joint Detail: Square

I. Thickness: 1/2".

J. Modular Size: 24 by 24"

K. Metal Suspension System.
1. Manufacturer: USG
2. Product: Donn DX
3. Size: 15/16”
4. Color: Flat White

L. Location: Cafe Service, Kitchen, Bistro

M. URL: https://www.usg.com/content/usgcom/en/products/ceilings/ceiling-tiles-panels/acoustical-panels/sheetrock-lay-in-gypsum-acoustical-panels.3260.html

1.02 ACT-21

A. Manufacturer: Armstrong

B. Product: Lyra 8357PBWBS

C. Color: Brown Sugar Walnut

D. NRC: 0.95

E. Edge Detail: Axiom trim.
1. Size: 4" nom
2. Color: Coffee (SCE). SW6258

F. Thickness: 1"

G. Size: 24" x 48"

H. Install: Hangar Rib/Threaded Rod

I. Acoustical Suspension System:
1. Manufacturer: Armstrong Commercial
2. Product: Suprafine XL
3. Size: 9/16”
4. Color: Black
5. Install: Hangar Rib/Threaded Rod

J. Location: Yoga Foyer.

K. Contact: Lisa Cavataio E-mail: lycavataio@armstrongceilings.com Phone: 773-882-0299

L. URL: https://www.armstrongceilings.com/commercial/en/commercial-ceilings-walls/woodworks-grille-tegular-ceiling-tiles.html

1.03 ACT-100

A. Manufacturer: USG
B. Product: Mars Clima Plus
C. Code: No. 86985
D. Color: White
E. NRC: 0.75
F. CAC: 35
G. LR: 0.90
H. Edge Detail: FLB
I. Thickness: 3/4"
J. Size: 24" x 24"
K. Metal Suspension System
    1. Manufacturer: USG
    2. Product: Centricitee DXT
    3. Size: 9/16"
    4. Wall Angle: M7
        a. Wall angle dimension: 7/8"
    5. Color: Flat White 050
L. Location: Where indicated on drawings.
M. URL: https://www.usg.com/content/usgcom/en/products/ceilings/ceiling-tiles-panels/acoustical-panels/mars-acoustical-panels.86985.html

1.04 ACT-100B

A. Manufacturer: USG
B. Product: Mars Clima Plus
C. Code: No. 88985
D. Color: White
E. NRC: 0.75
F. CAC: 35
G. LR: 0.90
H. Edge Detail: FLB
I. Thickness: 3/4"
J. Size: 24" x 48"
K. Metal Suspension System
    1. Manufacturer: USG
    2. Product: Compasso
    3. Size: 9/16"
    4. Wall Angle: Standard 4"
        a. Wall angle dimension: 4" x 9/16"
    5. Color: Flat White 050
L. Location: Cycle, Group #1 & 2, Barre, Pilates and Yoga / MB360
M. URL: https://www.usg.com/content/usgcom/en/products/ceilings/ceiling-tiles-panels/acoustical-panels/mars-acoustical-panels.86985.html

SCHEDULE OF FACEPLATE AND WIRING DEVICES COLORS BY CEILING FINISH:

2.01 BROWN FACEPLATES ARE TO BE USED ON CEILINGS WITH THE FOLLOWING FINISHES:

A. ACT-21

2.02 ALL OTHER FACEPLATES AND WIRING DEVICES INSTALLED ON ACT CEILINGS ARE TO BE WHITE.

END OF SECTION

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SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.
   1. Interior Application.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 05 21 00 - Steel Decking.

F. Section 07 92 00 - Joint Sealants.

G. Section 09 21 16 - Gypsum Board Assemblies.

H. Section 09 51 13 - Acoustical Panel Ceilings.

I. Section 26 27 26 - Wiring Devices. Coordinate color of wiring devices with the work of this Section.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

I. ASTM E413 - Classification for Rating Sound Insulation; 2022.

J. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.

D. Samples: Submit two samples illustrating color and finish of components exposed to view.

E. Installer's qualification statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Linear Panels: Ten, standard length.

G. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section.
   1. Approved by metal ceiling manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty:
   1. (LMC-2) Provide 1 year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.
   2. (LMC-3) Provide 15 year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Linear Metal Ceilings:
   1. Certainteed; Box Series:
      a. LMC-2B, Interior Application:
         1) Series: Deep Box 4
         2) Color: Regatta Teak
         3) Size: 4" x 16'-0"
         4) Panel Depth: 1"
         5) Carrier Spacing: 4' OC.
         6) Acoustic Panel Backer: 1 1/2" Polywrapped Fiberglass.
         7) Overall Depth: 2 1/8"
         8) Contact: Paul Teagan; 763.475.1340
         9) URL: https://certainteed.widen.net/view/pdf/awqtqqgj2s/metal-box-series-data-sheet-e-us-2206ctc.pdf?t.download=true&u=ictwif
      b. LMC-2C, Wet Suite Application:
         1) Series: Deep Box 4
         2) Color: Regatta Teak
         3) Size: 4" x 16'-0"
         4) Panel Depth: 1"
         5) Carrier Spacing: 2' OC.
         6) Acoustic Panel Backer: None, provide black metal filler strip by Manufacturer.
         7) Overall Depth: 2 1/8"
         8) Contact: Paul Teagan; 763.475.1340

9) URL: https://certainteed.widen.net/view/pdf/awqtqqgj2s/metal-box-series-data-sheet-e-us-2206ctc.pdf?t.download=true&u=ictwif

2. Longboard Architectural, V-Groove:
   a. LMC-3, Interior or Exterior Application, Walls or Ceilings:
      1) Series: 6" V-Groove Plank
      2) Color: Rock Elm
      3) Size: 6" x 12'
      4) Panel Depth: 9/16"
      5) Installation: Straight Stacked
3. Substitutions: Not permitted.

2.02 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:
   1. Design to support imposed loads of indicated items without eccentric loading of supports.
   2. Design for maximum deflection of 1/360 of span.
   3. Surface Burning Characteristics: Flame spread index of >25, smoke developed index of >50, when tested in accordance with ASTM E84.

2.03 COMPONENTS

A. LMC-2B and C:
   1. Linear Metal Panels:
      a. Type: Linear panel with reveals; snap-in installation.
         1) Size and Configuration: As indicated on drawings.
         2) Panel Profile: Box shaped.
      b. Material: Aluminum sheet, ASTM B209/B209M.
         1) Finish: Wood Veneer. See above for type.
   2. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance. Provide in dry interior applications only.
   3. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels. Matte finish, Black.
      a. Metal Filler Strip: As recommended by Manufacturer for Exterior Application.
   4. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
   5. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
   6. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
   7. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch (2.91 mm) diameter.
   8. Subgirt Members: Hot-dip galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.
   9. Insulation: Acoustical Insulation where indicated.
      a. Polywrapped Fiberglass acoustic insulation by Manufacturer.
         1) Thickness: 1.5"
         2) Density: 1.5 pcf.
         3) Color: Black.
         4) Finish: Matte.

B. LMC-3:
   1. Tongue and Groove metal panelling system:
      a. Type: Tongue and Groove Soffit or Wall installation, see drawings.

C. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance. Provide in dry interior applications only.

1. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels. Matte finish, Black.
2. Metal Filler Strip: As recommended by Manufacturer for Exterior Application.
3. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.
4. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.
5. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

D. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch (2.91 mm) diameter.

E. Subgirt Members: Hot-dip galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.

F. Insulation: Acoustical Insulation where indicated.
1. Polywrapped Fiberglass acoustic insulation by Manufacturer.
a. Thickness: 1.5"
b. Density: 1.5 pcf.
c. Color: Black.
d. Finish: Matte.

2.04 COORDINATION WITH WORK OF OTHER SECTIONS

A. Color of faceplates and wiring devices installed in linear metal ceilings
1. Brown.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:
1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.

B. Linear Metal Ceiling:
1. Install linear panels, baffles, and other system components in accordance with manufacturer's instructions.
2. Stagger end joints minimum 12 inches (300 mm).
3. Provide expansion joints to accommodate plus or minus 1 inch (25 mm) movement and maintain visual closure.
4. Install end caps at sight-exposed ends of linear panels.
5. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

C. Insulation: Install above panel members; fit tight between grid members; place insulation with facing side down.

3.03 CLEANING

A. Clean exposed surfaces.

B. Replace damaged or abraded components.

END OF SECTION

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SECTION 09 62 38
TILE WET AREA SURFACING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: EVA-PE copolymer tile wet area surfacing system.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast in Place Concrete.

E. Section 13 11 13 - Below Grade Swimming Pools.

F. Section 13 11 15 - Swimming Pool Finishes.

1.03 REFERENCED STANDARDS

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):
   1. ASTM E648-03 is for “Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source – Passed
   2. ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment: Critical Fall Height 1’ or More.
      a. Toxic Characteristic Leaching Procedure (TCLP) (RCRA) by Method 30106. NSF/ANSI/CAN Standard 50-26 Interactive Water Play Venue Surfacing Systems and Pool Perimeter Finishes - Certified
   3. ASTM C423-23: “Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.” The specimen mounting was performed according to ASTM E795-23:

B. AS 4586 – REQUIRED COMPLIANCE:
   1. AS HB198:2014 Pendulum With TRL (55) Soft Rubber Slider Flooring Slip Resistance Test: Ripple Pattern Dry 119, Wet 66
   2. 2013 slip resistance classification of new pedestrian surface materials, Appendix C – Wet-Barefoot Inclining Platform Test:
      a. Critical angle: 31°, Classification C.

C. INTERNATIONAL MARITIME ORGANIZATION (IMO):
   1. IMO Res. MSC.307(88) – (2010 FTP Code) Annex 1 Part 2 and Part 5 - Certified for Fire Safety Rating.
      a. IMO Certification is a fire safety rating for flooring, which approves its use for both indoor and outdoor applications on cruise ships.

D. TECHNISCHER ÜBERWACHUNGSVEREIN (TÜV):
   1. DIN EN 13451-1:2016-12 for slip-resistance - Certified

E. AMERICANS WITH DISABILITIES ACT (ADA):
   1. ASTM F1951: Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment - Compliant
   2. Compliance and adherence to ADA standards to ensure that individuals with disabilities have equal access and opportunities in various aspects of public Life, specifically at aquatic facilities.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Project Coordination:
   1. Coordinate installation with work of other trades, especially aquatics process.

B. Project Meetings:
   1. Attend project coordination and preinstallation meeting of the concrete substrate.

a. Requirements of the surfacing material shall be reviewed at the meeting.

2. Attend project coordination meetings and pre-installation meetings, which include related work or which are specified and requested by the architect, owner's representative, or engineer.

1.05 QUALITY ASSURANCE

A. Performance Criteria:
   1. Provide, as listed below, the minimum requirements to achieve certification in accordance with the NSF/ANSI/CAN Standard 50-26 listing for safety surfacing.
   2. The specified Material has been tested and certified as meeting all of the following performance standards.
   3. The safety surface must be impervious with chemical resistance to meet or exceed applicable building codes and the contract documents.

B. Slip Resistance:
   1. All surfaces must be slip-resistant to reduce slip-and-fall injuries. The minimum performance criterion requires a minimum 40 British Pendulum Number (BPN) and P4 on the Australian Standard.

C. Cushion:
   1. All surfaces must be cushioned to absorb falls. Criteria requires a Head Injury Criterion (HIC) value of 750 or lower and a Gmax of 200 or lower, with a 0.2-meter minimum fall height.

D. Impermeability:
   1. Surfaces are impermeable and do not absorb substances.
   2. Sunscreen, fertilizer run-off, liquids, and hazardous substances shall not absorb into surfaces.

E. Cleanability:
   1. Surfaces must be easily cleanable and hygienic.
   2. Surfaces shall show a 99.9% bacteria reduction after sanitization in accordance with the Model Aquatic Health Code (MAHC).

F. UV Resistance:
   1. Surfaces remain slip-resistant, cushioned, and retain contrasting colors after exposure to 750 hours of UV without showing signs of erosion.

G. Chemical Resistance:
   1. Certified surfaces remain slip-resistant, cushioned, and retain contrasting colors after exposure to chemical shock periods without showing signs of erosion.

H. Single Manufacturer Requirement:
   1. All materials provided under this Section shall be sourced by the Manufacturer of the specified product, or be recommended by that Manufacturer for use with their products.

1.06 PERFORMANCE REQUIREMENTS

A. Provide a single-layer EVA-PE copolymer tile wet area surfacing system that has been designed, manufactured, and installed to meet the following criteria:
   1. Shock Attenuation (ASTM F1292) – 3/8" 0.39 inch (10 mm) meets 1' (1.02 feet (31 cm)) critical fall height; 7/8" (0.87 inch (22 mm)) meets 4' (1.33 yard (1.22 meter)) critical fall height; 1'-1/4" (1.25 feet (38 cm)) meets 6' (2 yard (1.83 meter)) critical fall height.
   2. Gmax - Less than 200.
   3. Head Injury Criteria (HIC) - Less than 1000.
   4. Flammability (ASTM E648) – Class 1.
   5. Toxic Characteristic Leaching Procedure (TCLP) (RCRA) by Method 3010 – Pass.

B. NSF/ANSI/CAN certified to Standard 50-26 Interactive Water Play Venue Surfacing Systems and Pool Perimeter Finishes (latter omits impact absorption as a criterion).

C. Certifications:
   1. Each product and its systems requirements must pass specific performance measures for slip-resistance, impact absorption, chemical resistance, cleanability, UV resistance, impermeability as described above, and achieve compliance with NSF/ANSI/CAN Standard 50-26.

1.07 SUBMITTALS

A. Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Certifications:
   1. Installer shall be certified by product Manufacturer.

C. Product Data:
   1. Submit the manufacturer’s product data and installation instructions, recommendations, and requirements.

D. Verification Samples:
   1. Submit one 24” x 24” 2 feet (61 cm) x 61 cm) full-size sample for texture and thickness verification.
   2. Color verification to come in standard manufacturer sample packets, texture and thickness subject to inventory.

E. Shop drawings:
   1. Provide the following:
      a. Plan view of area of installation, including pattern and any coordination items.
      b. Typical installation details.

F. Closeout Submittals: Submit the following:
   1. Warranty documents specified herein.
   2. Operations and maintenance documentation.

G. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Contractor within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.08 DELIVERY, STORAGE AND PROTECTION

A. Deliver materials in Manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store all tile materials and adhesive securely and protected from exposure to harmful environmental conditions and at a minimum temperature of 60° F (15° C) and a maximum temperature of 90° F (32° C).

1.09 PROJECT/SITE CONDITIONS

A. Environmental requirements:
   1. Provide and install in strict accordance with the surfacing system’s published information, recommendations, and requirements. Perform installation when the ambient temperature is between 60°F (15°C) minimum and 90°F (32°C) recommended maximum.

B. Product requires a substrate with a steel trowel finish similar to the International Concrete Repair Institute’s CSP-1.

C. Do not install during rain events.

1.10 WARRANTY

A. Installation Warranty:
   1. Provide in accordance with the conditions of the contract for project warranty provisions.
      a. Duration: 1 year.

B. Manufacturer's Warranty:
   1. Submit Manufacturer's standard warranty document executed by an authorized company official.
      a. Duration: 5 years.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Life Floor, 2010 E Hennepin Ave, Building 8, Suite 206, Minneapolis, MN 55413 United States, Phone: (612) 567-2813. E-mail: solutions@lifefloor.com; Website: www.lifefloor.com.

B. Substitutions:
   1. No substitutions are permitted.

C. Life Floor® Safety Surfacing System:
   1. (**WST-1**) EVA-PE COPOLYMER TILE WET AREA LIFE FLOOR® Safety surfacing system, including the following.
      a. Life Floor®:
         1) Shape:
            (a) Square 24"
         2) Pattern:
            (a) 1/2 Offset.
         3) Thickness:
            (a) 3/8"
         4) Texture:
            (a) Ripple.
         5) Color:
            (a) Kestrel.

2.02 MATERIALS

A. Tile: EVA-PE copolymer tile wet area surfacing system: factory-molded surface composed of EVAtrax™, an ethyl vinyl acetate copolymer.
   1. Factory-molded surface composed of EVAtrax™, an ethyl vinyl acetate copolymer.

B. Substrate preparation materials:
   1. Basis of Design for Waterproof BaseCrete Flexible Waterproof system by BaseCrete Technologies, LLC, 6148 Clark Center Ave., Sarasota, Florida 34238; 941-312-5142; www.BaseCreteusa.com.

C. Adhesive: As recommended by Manufacturer for the project installation and use conditions.

PART 3: EXECUTION

3.01 EXAMINATION

A. Verification of Existing Conditions:
   1. Verify that substrate conditions are suitable for the installation of the EVA-PE copolymer wet area surfacing system.
   2. Ensure concrete substrate drainage conforms with Manufacturer's requirements.
      a. See Manufacturer's instructions with regard to concrete mix, slope, and texture.
      b. Concrete surface must be fully dry before installation.
   3. Do not proceed with installation until unsuitable conditions are corrected.

3.02 PREPARATION OF CONCRETE SUBSTRATE

A. General:
   1. Provide in accordance with these specifications for field quality control requirements.
      a. Cut and trim plumbing pipes entering the basin(s) flush with walls and floor surfaces (allowing for the thickness of the new finishes' execution).
      b. Remove the internal blanking disk or pressure plugs after the construction of the basin, but before the interior finish work is installed.
         1) Before removing the blanking disc or pressure plugs, verify that the specified pressure test was in place in accordance with these specifications' requirements.
      c. Water-flush plumbing pipes enter the basin(s) with chlorinated water before acid-washing the pool(s). Remove chlorinated water before proceeding.

B. Surfaces must be adequately prepared and suitable for installation in accordance with the Manufacturer's guidelines.
   1. In addition, all of the substrate's floor and deck slopes must be verified and adjusted as required before providing the Manufacturer's guidelines and their related adhesives.
      a. Planeness: When a straight-edge tool (measuring in length [3.28] yard ([3] meter) or 9.84 ft, to the nearest foot) is placed on the substrate surface at any position, no part of the substrate surface shall be more than 1/8" [0.12] inch ([3] mm) below the straight-edge tool.
      b. Smoothness: When a straight-edge tool (measuring 5.91 inch (150 mm) or 6" long) is placed on the substrate surface at any position, no part of the surface shall be more than 1/32" (0.04 inch (1 mm)) below the straight-edge.
      c. Slopes:
         1) Provide a minimum of 2% slope to a maximum of 4% slope in accordance with the contract documents, towards the deck drains to allow for code requirements and the specifier's specified drainage in the contract documents.
         2) Provide in accordance with the local building code and the contract documents for sloping requirements for the project's application.
      d. Slab Recesses:
         1) When providing and accommodating the 3/8" tile depth, the contractor must provide a 1/4" recess for concrete and vertical obstructions in order to eliminate the need for ADA-compliant transition strips.
         2) From the recessed concrete, provide a 1/4" raise for fixtures and drains so they will sit flush with the top of the finished surface.

C. Measure and report the pH of any concrete slab before installing finish. The pH of the slab must be within the suggested range of the adhesive (contact adhesive manufacturer for exact range). If the pH is not within the suggested range, do not install the finishes until it complies with the manufacturer's adhesive requirements.
   1. Failure to comply with these standards will likely result in an unsatisfactory bond, which is a contractor deficiency and error, causing a potential complete removal and a new re-installation, after corrections are implemented, at the contractor's expense.

3.03 INSTALLATION OF FINISHES

A. Follow and observe the tile manufacturer's instructions, recommendations, requirements,and the approved shop drawings.

3.04 REPLACEMENT OF DAMAGED MATERIALS

A. Remove and replace finishes, and materials chipped, cracked, abraded, improperly adhered, otherwise damaged, or deemed unacceptable by the engineer or architect.

3.05 CLEAN-UP AND PROTECTION

A. After the work has been completed, clean up work areas and remove equipment, excess materials, and debris.

B. Protect areas of installation from damage until the substantial completion date.

END OF SECTION

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SECTION 09 64 00
WOOD FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hardwood base and trim.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 03 30 00 - Cast-in-Place Concrete.

F. Section 06 10 00 - Rough Carpentry.

G. Section 06 40 01 - Wood Flooring Schedules.

H. Section 07 92 00 - Joint Sealants.

I. Section 09 05 61 - Common Work Results for Flooring Preparation.

J. Section 09 21 16 - Gypsum Board Assemblies.

K. Section 09 21 17 - Gypsum Board Shaft-Wall Assemblies.

L. Section 09 30 00 - Tiling.

M. Section 09 65 19 - Resilient Flooring.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

B. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

C. Comply with GBC, Section 5.504.4.5 - Composite wood products and Table 5.504.4.5 - Formaldehyde Limits

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for laminated wood flooring installation indicated.

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store laminated wood floorings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive laminated wood floorings during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during laminated wood flooring installation.

D. Close spaces to traffic for 48 hours after laminated wood flooring installation.

E. Install laminated wood floorings after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 WOOD BASE

A. See Attached Schedule.

2.02 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit laminated wood flooring and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of specified materials.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install laminated wood floorings until they are same temperature as space where they are to be installed.

D. Sweep and vacuum clean substrates to be covered by laminated wood floorings immediately before installation.

3.03 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of laminated wood floorings.

B. Perform the following operations immediately after completing laminated wood flooring installation:
   1. Remove adhesive and other blemishes from laminated wood flooring surfaces.

2. Sweep and vacuum laminated wood floorings thoroughly.
3. Damp-mop laminated wood floorings to remove marks and soil.

C. Protect laminated wood floorings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover laminated wood floorings until Substantial Completion.

END OF SECTION

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SECTION 09 64 01
WOOD FLOORING - SCHEDULE

WOOD BASE

1.01 WB-13:

A. Species: Walnut Wood Base

B. Size: 4” x 5/8” with 45 degree beveled edge

C. Finish: Custom Stain to match PLAM-34, clear finish.

D. Location: See drawings.

END OF SECTION

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SECTION 09 65 19
RESILIENT FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rubber tile flooring.
   2. Vinyl composition floor tile.
   3. Static dissipative tile, with copper grounding strips.
   4. Luxury vinyl plank floor tile.
   5. Resilient Sheet/Roll flooring.
   6. Resilient molding accessories.
   7. Floor paint.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 03 30 00 - Cast in Place Concrete.

F. Section 09 05 61 - Common Work Results for Flooring Preparation.

G. Section 09 30 00 - Tile.

H. Section 09 64 00 - Wood Flooring.

I. Section 09 65 20 - Resilient Tile Flooring Schedules.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emissions Standards for Consumer and Commercial Products; Current Edition.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

E. GBC, Section 5.504.4.6 - Resilient flooring systems.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units of each color and pattern of floor tile required.

C. Samples for Color Selection: For each of the following items.
   1. Floor Transitions.
   2. Stair Nosings.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 86 deg F (30 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 86 deg F (30 deg C).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 48 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

1.08 WARRANTY

A. Provide Manufacturer's standard warranty for each tile/system.

PART 2 PRODUCTS

2.01 RUBBER FLOOR TILE

A. See Attached Schedule.

2.02 STATIC DISSIPATIVE TILE FLOORING

A. See Attached Schedule.

2.03 LUXURY VINYL PLANK TILE

A. See Attached Schedule.

2.04 RESILIENT ROLL/SHEET FLOORING

A. See Attached Schedule

2.05 RESILIENT BASE

A. See Attached Schedule.

2.06 VINYL RESILIENT BASE

A. See Attached Schedule.

2.07 RESILIENT MOLDING ACCESSORIES

A. Flooring Transition:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johnsonite. (Basis of Design)
      b. Armstrong World Industries, Inc.
      c. Roppe Corporation, USA.
      d. VPI, LLC; Floor Products Division.
   2. Description: Carpet edge, reducer strip for resilient floor covering, and transition strips.

3. Material: Rubber.
4. Profile and Dimensions: As indicated.
5. Transition type:
    a. LVT to Isolated floor slab:
        1) Manufacturer: Johnsonite
        2) Product: CD-XX-C and Track Base MT-00A
        3) Color: TB1 Peppercorn
        4) Location: Yoga, Group Fitness, see drawings.
    b. LVT to VCT:
        1) Manufacturers: Johnsonite
        2) Product: SLT-XX-A Slimline Transition
        3) Color: TB1 Peppercorn
        4) Location: Fitness Floor
    c. LVT to CPT:
        1) Manufacturers: Johnsonite
        2) Product: SLT-XX-F Slimline Transition
            (a) Color: TB1 Peppercorn
        3) Location: Spa Treatment to waiting
    d. LVT to Resilient Athletic Sports Surface (Racquet Sports):
        1) Manufactuer: Schluter
        2) Product: Vinpro-U
        3) Finish: To be selected by Architect
        4) Dimension: Coordinate with LVT depth
        5) Location: Pickleball
    e. LVT to Resilient Sheet Flooring:
        1) Manufacturer: Johnsonite
        2) Product: CD-XX-X and Track Base MT-00A
        3) Color: TB1 Peppercorn
        4) Dimension: Coordinate with flooring depths
        5) Location: Fitness Floor, LT Kid's Gym and Movement Studio
    f. Rubber Floor to Resilient Sheet Flooring
        1) Manufacturer: Johnsonite
        2) Product: CCA-XX Adaptor
        3) Color: TB1 Peppercorn
        4) Location: Group Fitness Studio to Fitness Floor
    g. Resilient Sheet Flooring (RSF-3) to Resilient Sheet Flooring (RSF-4)
        1) Manufacturer: Johnsonite
        2) Product: CD-XX-X and Track Base MT-00A
        3) Color: TB1 Peppercorn
        4) Location: Movement Studio
    h. Resilient Sheet Flooring to Concrete
        1) Manufacturer: Johnsonite
        2) Product: CD-XX-X and Track Base MT-00A
        3) Color: TB1 Peppercorn
        4) Dimension: Coordinate with flooring depths
        5) Location: Fitness Floor, LT Kid's Gym, and Movement Studio
    i. LVT to Concrete:
        1) Manufacturer: Schluter
        2) Product: Vinpro-U
        3) Color: TB1 Peppercorn
    j. Levelers:
        1) LS-40-X
            (a) Manufacturer: Johnsonite

(b) Color: Black
(c) Location: Floor transitions as necessary

B. Resilient Expansion Covers:
1. Manufacturers and products: Subject to compliance with requirements, provide one of the following:
a. Johnsonite: CD-XX-C.
b. Armstrong World industries, Inc.
c. Roppe Corporation, USA.
d. VPI, LLC; Floor Products Division.
2. Description: Covering for expansion joints in LVT material on details.
3. Material and Color: Match floor material.

C. Aluminum Expansion Covers: Provide type as shown on details.
1. Aluminum Transitions:
a. Inpro Architectural Products 801 Series floor expansion joint cover (ADA saddle threshold).
1) Size: coordinate with size of joint.
b. Or approved equal.

2.08 FLOOR PAINT

A. Where indicated on drawings, apply paint at play surfaces:
1. Manufacturer and Product:
a. Endura Low VOC EX-2C Topcoat Gameline Coating.
b. Endura Prepare Thinner II.
2. Description: two component polyurethane paint and adhesion promoter.
3. 2" wide lines, color as indicated on drawings.

2.09 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static Dissipative Tile Adhesive: 2 in. (5.08 cm) wide x 24 in. (60.96 cm) long copper ground-connection strips under the tile and wall base as recommended by the flooring manufacturer.

C. Rubber Tile Adhesives: Certified by the Manufacturer: PU 105 polyurethane adhesive or EP 55 epoxy adhesive. Refer to instruction manual of adhesives provided by rubber athletic flooring Manufacturer.

D. Adhesives: Water-resistant, mildew-resistant, no staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed resilient tile and as recommended/ required by the manufacturer for warrantee acceptance or provided by resilient tile manufacturer for the type of flooring being installed.

E. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

F. VCT and Asphalt Tile Adhesives: 50 g/L.

G. Cove Base Adhesives: 50 g/L.

H. Rubber Floor Adhesives: 60 g/L.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings 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.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation 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) in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor materials until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor.

B. Lay out floor tiles/rolls from center marks established with principal walls, discounting minor offsets, so tiles/rolls at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half unit at perimeter.
   1. Lay tiles/rolls square with room axis.

C. Expansion Joints: Provide expansion joints as required by manufacturer.
   1. Joints to be located as indicated on drawings, or placed equidistant throughout surface.
   2. Install cover strips as specified.

D. Match floor tiles/rolls for color and pattern by selecting from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Unroll and install all rolled goods in the same direction.

E. Scribe, cut, and fit floor tiles/rolls to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor tiles/rolls into toe spaces, door reveals, closets, and similar openings. Extend floor tiles/rolls to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles/rolls as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

H. Install floor tiles/cut rolls on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of material installed on covers and adjoining material. Tightly adhere edges to substrates that abut covers and to cover perimeters.

I. Adhere floor tiles/rolls to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

J. Install copper grounding strips into adhesive in strict accordance with manufacturer's written instructions.

K. Roll flooring with a 100-pound (45.36 kilogram) roller. Refer to specific rolling instructions of the flooring manufacturer.

3.04 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates. Do not stretch resilient base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible.

H. Mitered Corner:
   1. Where two base pieces meet at a corner, inside or outside, both shall be mitered.
   2. Butting base materials together at corners is not acceptable.

3.05 RESILIENT MOLDING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

D. Provide transition/reducing strips tapered to meet abutting materials.

E. Provide threshold of thickness and width as shown on the drawings.

F. Provide resilient edge strips of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

3.06 FLOOR PAINT INSTALLATION

A. Comply with manufacturer's written instructions.

B. Prepare floor surfaces as indicated by manufacturer.
   1. Mark off lines as indicated on drawings with solvent resistant tape.
   2. Sand and clean.
   3. Apply Prepare Thinner II to areas to be painted. Do not apply thinner to other areas.
   4. Apply paint lines according to manufacturer's instructions.
   5. Allow paint to cure according to manufacturer's instructions. Do not allow any traffic during this period.

3.07 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor.

B. Perform the following operations immediately after completing floor installation:
   1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor products from marring, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor until Substantial Completion.

END OF SECTION

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SECTION 09 65 20
RESILIENT FLOORING - SCHEDULE

RUBBER FLOOR TILE

1.01 RT-2:

A. Distributor: Hank's Specialties
B. Manufacturer: Tarkett / Johnsonite
C. Product: Triumph Sports and Multi-Function Rubber Flooring
D. Thickness: 3/8'' (10 mm)
E. Tiles: 24" x 24"
F. Colors: "LTF Custom Brown"
G. Installation: 1/2 Ashlar
H. Location: Free Weights, GTX, KA-Movement Studio, Alpha
I. Contact: Rich Miessner, 651.633.5020
J. URL: https://www.tarkettexchange.com/m/5a54639d98130cee/original/DS_TNA_TRIUMPH.pdf

1.02 RT-8:

A. Manufacturer: Ecore
B. Product: Heritage Motivate
C. Size: 6" x 48" Plank
D. Thickness: 7 mm
E. Colors: Northwood 1005
F. Installation: 1/3 Offset
G. Location: Group Fitness #1, #2 and Yoga
H. URL: https://ecoreathletic.com/performance-vinyl-tile/heritage-motivate

STATIC DISSIPATIVE TILE FLOORING

2.01 VCT-3:

A. Manufacturer: Static Smart
B. Static Dissipative Tile (SDT) ESD
C. Color: Rainer C6005
D. Size: 12"x12"
E. Thickness: 1/8"
F. Location: MDF Room
G. URL: https://staticsmart.com/resilient-flooring/esd-vinyl-tile/

LUXURY VINYL PLANK TILE

3.01 LVT-17A2:

A. Manufacturer: Mohawk
B. Product: Life Wood
C. Color: Endurance
D. Size: 9" x 59"
E. Thickness: 5mm
F. Wear Layer: 20 mil
G. Installation: Glue-down: M-Force Enhanced Urethane

H. Location: Spa Treatment Rooms, Mothers Room, Education Center, LT Recovery, fitness floor, kids academy activities & language arts, pilates, yoga, cycle, offices and elevator.

I. Contact: Casey Barbee email: casey_barbee@mohawkind.com

J. URL: https://www.mohawkgroup.com/detail/HardSurface/14795/182458/Better-Together-12-x-36

RESILIENT ROLL/SHEET FLOORING

4.01 RSF-3:

A. Manufacturer: Ecore

B. Product: Baller Motivate Class 1

C. Size: 70" x 65' Roll

D. Thickness: 7 mm

E. Color: Spike

F. Installation: Sheet

G. Location: LTKA Gym

H. Contact: Dan Anderson dmanderson@ecoreintl.com

I. URL: https://ecoreathletic.com/products/vinyl/sheet-vinyl/baller/baller-motivate-class-i

VINYL COMPOSITION FLOOR TILE ACCESSORIES

5.01 RESILIENT BASE

A. RB-3:
1. Color: Black
2. Size: 4” cove base
3. Location: Back of House at drywall walls only – Install at Drywall Only. Do not apply to CMU.

B. RB-9
1. Manufacturer: Johnsonite
2. Product Profile: MW-66-F- Reveal
3. Color: 66 Either Ore
4. Size: 4.25” Wall Base
5. Thickness: 0.25"
6. Location: Reception, Offices, Spa waiting, Spa treatment, Fitness floor, Cycle, Mothers Room, LT Recovery
7. URL: https://commercial.tarkett.com/en_US/collection-C001527-scs-color-chips/66-either-ore

5.02 VINYL RESILIENT BASE

A. VB-2:
1. Manufacturer: Johnsonite
2. Product: CB-XX
3. Color: 66 Either Ore
4. Size: four (4”) inch cove base
5. Location: Kids Academy
6. URL: https://commercial.tarkett.com/en_US/collection-C001527-scs-color-chips/66-either-ore

END OF SECTION

SECTION 09 67 23
RESINOUS FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes resinous, epoxy flooring.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 03 30 00 - Cast in Place Concrete.

F. Section 09 05 61 - Common Work Results for Flooring Preparation.

G. Section 09 65 19 - Resilient Flooring.

1.03 REFERENCE STANDARDS

A. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings; 2018.

B. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes; 2023.

C. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes; 2018 (Reapproved 2023).

D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

E. ASTM D2369 - Standard Test Method for Volatile Content of Coatings; 2020.

F. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

G. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser; 2019.

H. ASTM E413 - Classification for Rating Sound Insulation; 2022.

I. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

J. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

K. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

L. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; 2016.

M. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 5 inches (150 mm) square, applied to a rigid backing.

C. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in product schedule.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. No request for substitution shall be considered that would change the generic type of floor system specified (i.e. epoxy mortar based system with decorative quartz topping). Equivalent materials of other manufactures may be substituted only on approval of Architect or Engineer. See 01 33 00 Submittal Procedures and 01 60 00 Product requirements.

C. Installer Qualifications:
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least 10 projects of similar size and complexity.

D. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

E. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.
   1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

F. Pre-installation Conference:
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. General Contractor
      b. Architect/Owner's Representative.
      c. Manufacturer/Installer's Representative.

1.06 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.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per product data sheet.

C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.07 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.

1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after 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.

D. Concrete substrate shall be properly cured. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

1.08 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 PRODUCTS

2.01 RESINOUS FLOORING

A. Resinous Flooring with Epoxy base and Quartz broadcast. (**RF-1**)
   1. Acceptable Manufacturers:
      a. Stonhard.
      b. Tnemec.
      c. Neogard.
      d. Or approved equal
   2. Products: Subject to compliance with requirements:
      a. Stonhard, Inc.; Stonshield HRI®.
      b. Tnemec; Deco-Tread N222 Quartz System
      c. Neogard; NeoQuartz HD
      d. Or approved equal.

B. System Characteristics:
   1. Color and Pattern:
      a. Basis of Design: Stonshield Frappe
      b. Or approved equal.
   2. Wearing Surface: Manufacturer's standard: medium texture.
   3. Integral Cove Base: 6”.
   4. Overall System Thickness: nominal 1/8" - 3/16”

C. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Primer:
      a. Manufacturer's standard primer as recommended for the substrate.
      b. Resin: Epoxy.
      c. Formulation Description: (2) two component, 100 percent solids.
      d. Application Method: Squeegee and roller.
      e. Number of Coats: (1) one.
   2. Mortar Base:
      a. Manufacturer's standard
      b. Resin: Epoxy.
      c. Formulation Description: (3) three component, 100 percent solids.
      d. Application Method: Metal Trowel.
         1) Thickness of Coats: nominal 1/8” (inch).
         2) Number of Coats: One.

e. Aggregates: Pigmented Blended aggregate.

3. Undercoat:
   a. Manufacturer's standard
   b. Resin: Epoxy
   c. Formulation Description: (2) two-component, 100% solids, UV Stable.
   d. Type: Clear.
   e. Finish: Gloss.
   f. Number of Coats: one.
4. Broadcast Media:
   a. Material Basis: Quartz aggregate
   b. Type: Pigmented.
   c. Finish: Standard.
   d. Number of Coats: One.
   e. Pattern: Tweed.
5. Sealer:
   a. Manufacturer's standard
   b. Resin: Epoxy.
   c. Formulation Description: (2) two-component, 100% solids, UV Stable.
   d. Type: Clear.
   e. Finish: Gloss.
   f. Number of Coats: one.
   g. Texture level: Standard

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   1. Compressive Strength: 10,000 psi after 7 days per ASTM C579
   2. Tensile Strength: 2,000 psi per ASTM C307
   3. Flexural Strength: 4,300 psi per ASTM C580
   4. Flexural Modulus of Elasticity: 2.0 x 106 psi per ASTM C580
   5. Hardness: 85 to 90 per ASTM D2240, Shore D
   6. Impact Resistance: > 160 in./lbs. per ASTM D2794
   7. Abrasion Resistance: 0.06 gm max. weight loss per ASTM D4060, CS-17
   8. Flammability: Class 1 per ASTM E648.
   9. Thermal Coefficient of Linear Expansion: 1.3 x 10-5 in./in. oF
   10. Water Absorption: 0.1% per ASTM E413
   11. VOC Content per ASTM D2369:
      a. Completed Assembly complies with requirements of USGBC LEED-NC
   12. Cure Rate @ 77oF/25oC:12 hours foot traffic, 24 hours normal operations.

2.02 ACCESSORY MATERIALS

A. Patching, Leveling and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean and dry substrate for resinous flooring application.

B. Concrete Substrates: Prepare concrete substrates with Topping and Repair material as specified in Section 03 30 00 - Cast in Place Concrete.
   1. 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.

2. Mechanically prepare substrates as follows:
    a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup, or Diamond Grind with dust free system.
3. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
4. Verify that concrete substrates meet the following requirements.
    a. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.
    b. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.
    c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.02 APPLICATION

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. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
    a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Integral Cove Base: Manufacturer's cove mortar, 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, of cove base. Round internal and external corners.
1. Integral Cove Base: 6 inches high, minimum.

C. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

D. Apply metal trowel single mortar coat in thickness indicated for flooring system into wet primer. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

E. Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

F. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

G. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.03 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.04 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints and maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Install backer rod and compatible sealant at vertical and horizontal control joints after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.05 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. 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.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.06 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General contractor is responsible for cleaning prior to inspection.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Paint systems including application on the following substrates:
      a. Concrete.
      b. Masonry.
      c. Ferrous Metal
      d. Non-Ferrous Metal.
      e. Gypsum board.
      f. Wood.
   2. Powder Coating systems including application on the following substrates:
      a. Ferrous Metal
      b. Non-Ferrous Metal.
   3. Products include applications for the following conditions:
      a. Interior/Dry Environment.
      b. Interior/Wet Chemical Environment.
      c. Interior/Wet Environment.
      d. Exterior.
   4. See the following sections for coating of other surfaces:
      a. 06 40 00 - Architectural Woodwork.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 01 60 00 - Product Requirements.
D. Section 03 30 00 - Cast-in-Place Concrete.
E. Section 04 20 00 - Unit Masonry.
F. Section 05 12 00 - Structural Steel Framing.
G. Section 05 21 00 - Steel Joist Framing.
H. Section 05 31 00 - Steel Decking.
I. Section 05 40 00 - Cold-Formed Metal Framing.
J. Section 05 50 00 - Metal Fabrications.
K. Section 06 40 00 - Architectural Woodwork
L. Section 08 11 13 - Hollow Metal Doors and Frames.
M. Section 08 31 13 - Access Doors and Frames
N. Section 09 21 16 - Gypsum Board Assemblies.
O. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.
P. Section 09 30 00 - Tiling
Q. Section 09 72 00 - Wall Coverings
R. Section 09 91 01 - Painting Schedules.
S. Section 26 27 26 - Wiring Devices. Coordinate color of wiring devices with the work of this Section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

C. GreenSeal GS-11 - Standard for Paints, Coatings, Stains, and Sealers; 2021, with Editorial Revision (2024).

D. ISO 2360 - Measurement of Coating Film Thickness; Current Edition.

E. ISO 2815 - Paints and Varnishes - Buchholz Indentation Test; Current Edition.

F. ISO 6270-1 - Paints and Varnishes - Determination of Resistance to Humidity; Current Edition.

G. ISO 9227 - Salt Spray Test; Current Edition.

H. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

I. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

J. PCI-PCCFH - Powder Coating: Complete Finisher's Handbook; Current Edition.

K. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

L. USGBC LEED-CI - LEED Green Building Rating System for Commercial Interiors; 2016.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit Samples (3) on rigid backing, 8 inches (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.
   2. Printout of current MPI (APL) "Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Painting:
   1. MPI Standards:
      a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
      b. Preparation and Workmanship: Comply with requirements in MPI (APSM) "Architectural Painting Specification Manual" for products and paint systems indicated.

C. Powder Coating:
   1. Provide materials in compliance with the following testing standards:
      a. ISO 2360 60-80 Nanometers
      b. ISO 9227 500 hours: max undercutting 1 mm
      c. ASTM D2794 no cracking
      d. ISO 6270-1 500 hours: max blistering 1 mm
      e. ISO 2815 >90

1.06 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.

1.07 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Painting Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin Williams Company, or comparable product by one of the following:
   1. Benjamin Moore & Co.
   2. Diamond Vogel Paints.
   3. Hirshfield's, Inc.
   4. PPG.

B. If a specific Manufacturer/Product is given in the Paint Schedule, furnish only that product for given application. Provide primers as recommended by that product's Manufacturer.

C. Match paint color provided in Schedule.

2.02 PAINT, GENERAL

A. 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.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   1. Low-Emitting Materials:
      a. Architectural paints and coatings applied on the building interior shall not exceed the VOC content limits established in GreenSeal GS-11 and USGBC LEED-CI
      b. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in GreenSeal GS-11, 2.5.
      c. Clear wood finishes, floor coatings, stains, primers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD 1113, Architectural Coatings.
   2. Colors: As indicated in a color schedule.

2.03 PAINTING SYSTEMS

A. Interior Dry Environment:
   1. Gypsum Board walls and ceilings, Typ.
      a. Primer:
         1) Interior Latex Primer, MPI #50
      b. Topcoat, (2) coats paint as indicated by surface:
         1) Interior Latex, MPI #53 (Flat)
         2) Interior Latex, MPI #54 (Semi-Gloss)
   2. Masonry, Concrete walls, Typ.

a. Primer:
1) Block Filler MPI #4.
b. Topcoat, (2) coats:
1) Interior Latex, MPI #53

3. Wood, where indicated to be painted, coordinate with millwork shop.
a. Primer:
1) Shop primed
2) Where not shop primed, Interior Latex, MPI #39
b. Topcoat
1) Alkyd, MPI #168

4. Non-galvanized Steel.
a. Primer:
1) Shop primed as specified
2) Anti-Corrosive Alkyd primer, MPI #79
b. Topcoat, (2) coats:
1) Alkyd, MPI #51, #47, #48; see below for gloss level per application

5. Galvanized Steel or Aluminum.
a. Primer:
1) Water Based MPI #134
b. Topcoat, (2) coats:
1) Alkyd, MPI #51, #47, #48; see below for gloss level per application.

B. Interior Pool, Mechanical and Chemical Storage Areas:
1. Glass-Mat Gypsum Board or Cement Board.
a. Primer:
1) Interior Latex Primer, MPI #50
b. Topcoat, (2) coats:
1) Water Based Catalyzed Epoxy, MPI #115

2. Masonry, Concrete walls.
a. Primer:
1) Block Filler MPI #4.
b. Topcoat, (2) coats:
1) Water Based Catalyzed Epoxy, MPI #115

3. Non-galvanized Steel.
a. Primer:
1) Shop primed as specfied
2) Water-based Rust inhibitive primer, MPI #107
b. Topcoat, (2) coats:
1) Water Based Catalyzed Epoxy, MPI #115

4. Galvanized Steel or Aluminum.
a. Primer:
1) Shop primed as specfied
2) Water-based Rust inhibitive primer, MPI #107
b. Topcoat, (2) coats:
1) Water Based Catalyzed Epoxy, MPI #115

C. Other Interior Wet areas (Locker rooms, Vanities, Toilets, etc):
1. Gypsum Board walls and ceilings, Typ.
a. Primer:
1) Interior Latex Primer, MPI #50
b. Topcoat, (2) coats:
1) Anti-Microbial Interior Latex, MPI #53

2. Non-galvanized Steel.
a. Primer:

1) Shop primed as specified
2) Water-based Rust inhibitive primer, MPI #107

b. Topcoat, (2) coats:
1) Alkyd, MPI #51, #47, #48; see below for gloss level per application

3. Galvanized Steel or Aluminum.
a. Primer:
1) Water Based MPI #134

b. Topcoat, (2) coats:
1) Alkyd, MPI #51, #47, #48; see below for gloss level per application.

D. Exterior:
1. Masonry, Concrete walls, Typ.
a. Primer:
1) Block Filler MPI #4.

b. Topcoat, (2) coats:
1) Exterior Latex, MPI #10

2. Non-galvanized Steel.
a. Primer:
1) Shop primed as specfied
2) Water-based Rust inhibitive primer, MPI #107

b. Topcoat, (2) coats:
1) HS Polyurethane Semi-Gloss, MPI #174

3. Galvanized Steel or Aluminum.
a. Primer:
1) Water Based MPI #134

b. Topcoat, (2) coats:
1) HS Polyurethane Semi-Gloss, MPI #174

2.04 PAINT FINISHES

A. Provide Paint finishes according to the types of surfaces applied to as follows, unless noted otherwise:
1. Ceilings/soffits: Flat
2. Food/Liquor spaces: Semi Gloss
3. Walls above wallcovering datum: Flat
4. Hollow metal doors: Semi-gloss
5. Painted wood: Satin enamel
6. Access Panels: Semi-gloss
7. Back of house, non public facing spaces: Semi-gloss

B. Note: MPI numbers given above refer to most typical conditions. In the event that those MPI numbers conflict with finishes here, select equivalent product in the gloss level indicated.

2.05 POWDER COATING

A. General: Provide powder coating systems by the Manufacturers and products as specified on the Powder Coating Schedule.

B. Exterior Applications:
1. Non-galvanized Steel
a. Polyester

2. Aluminum or Galvanized Steel
a. Fluoropolymer

C. Interior Applications:
1. Steel or Aluminum
a. Epoxy/Polyester blend

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION - PAINT

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" MPI (APSM) applicable to substrates indicated.

B. 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.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.03 APPLICATION - PAINT

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 equipment, AV equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed 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.

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.

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.

3.04 APPLICATION - POWDERCOATING

A. Perform coating and curing in shop according to Manufacturer's instructions and according to the methods of the PCI-PCCFH Handbook. Deliver parts with coating completed and in protective wrapping.

B. Inspect parts after installation for damage.

C. Touch-up damaged surfaces as recommended by Manufacturer.

D. Parts damaged in installation to an extent that acceptable touch ups and repairs cannot be performed shall be replaced at no cost to the Owner.

3.05 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. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 PAINT SCHEDULE

A. See Attached Schedule.

3.07 POWDER COATING SCHEDULE

A. See Attached Schedule.

END OF SECTION

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SECTION 09 72 00
WALL COVERINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Acoustical wall covering.
   2. Vinyl wall covering.
      a. Vinyl wall covering with perforations at all exterior walls with vapor barrier.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 09 21 16 - Gypsum Board Assemblies.

F. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

G. Section 09 72 00 - Wall Coverings Schedules.

H. Section 09 75 00 - Interior Stone.

I. Section 09 84 30 - Sound Absorbing Wall and Ceiling Units.

J. Section 09 91 00 - Painting.

K. Section 26 27 26 - Wiring Devices. Coordinate color of wiring devices with the work of this Section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ASTM F793/F793M - Standard Classification of Wall Coverings and Ceiling Coverings by Use Characteristics; 2025.

E. W-101 WA - WA QUALITY STANDARD FOR POLYMER COATED FABRIC WALLCOVERING; Current edition.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Samples for Verification: Full width by 36-inch- (914-mm-) long section of wall covering.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

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 E84:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.

1.06 PROJECT CONDITIONS

A. 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.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.02 ACOUSTICAL WALL COVERING

A. See Attached Schedule.

2.03 VINYL WALL COVERING

A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
   1. W-101 WA for Type II, Medium-Duty products.
   2. ASTM F793/F793M for wall coverings that qualify as Category V, Type II, Commercial Serviceability products.
   3. Perforated Vinyl Wall Covering: Provide perforations at all wall covering installed on exterior walls with vapor barrier.

B. See attached Schedule.

2.04 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Adhesive for Perforated Vinyl Wall Covering: Primer and Adhesive to be vapor permeable per ASTM E96/E96M-02.
      a. Gardner-Gibson: Dynamite 234.
      b. Roman (Sherwin Williams): Eco 788.
      c. Or approved substitution.

B. Primer/Sealer: Mildew-resistant primer/sealer recommended in writing by wall-covering manufacturer for intended substrate.
   1. Primer for Perforated Vinyl Wall Covering: Primer and Adhesive to be vapor permeable per ASTM E96/E96M-02.
      a. Use manufacturer's recommended permeable primer.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
4. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.03 INSTALLATION

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install reversing every other strip.

E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

F. Match pattern 72 inches (1830 mm) above the finish floor.

G. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

I. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.04 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Re-install hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 72 01
WALL COVERINGS - SCHEDULES

1.01 ACOUSTICAL WALL COVERINGS

A. AWC-13
   1. Manufacturer: Momentum
   2. Product ID: ASIL-24
   3. Collection: Silence
   4. Color: Kiwi
   5. Location: Kids Gym
   6. Contact: Anne Tripp, Atripp@momtex.com, 952-240-4863
   7. URL: https://momentumtextilesandwalls.com/products/09338668

1.02 VINYL WALL COVERING

A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
   1. CFFA-W-101-D for Type II, Medium-Duty products.
   2. ASTM F 793 for wall coverings that qualify as Category V, Type II, Commercial Serviceability products.

B. Perforated Vinyl Wall Covering: Provide perforations at all wall covering installed on exterior walls with vapor barrier, and interior walls opposite Yoga, Fitness Studios, Steam Room, Sauna, Locker room, Shower or Pool areas.

C. WC-1
   1. Manufacturer: Wolf Gordon
   2. Series: Summit
   3. Pattern: Caribe
   4. Color: Ventana CBE 6-1107
   5. Product ID: WG 5588890
   6. Width: 54”
   7. Location: Field wall covering, refer to drawings.
   8. Pricing Contact: Alfredo Ortiz; Alfredo.Ortiz@wolfgordon.com
   9. Sales Representative: Jessica Nalipinski; Jessica.Nalipinski@wolfgordon.com
   10. URL: https://www.wolfgordon.com/products/wallcovering/caribe-cbe-6-1107?srsltid=AfmBOooonYk92pGgWmyMmRy_4oQZyk9KqjQsNCpjiM_h-vvtdwEDKKY0

D. WC-4A
   1. Distributor: Koroseal
   2. Manufacturer: Arte
   3. Pattern: Sapphire
   4. Color: 69184
   5. Width: 52-54”
   6. Content: Vinyl
   7. Location: Yoga, Recovery, See Plans
   8. Contact: Natalia Haywood natalia.haywood@koroseal.com
   9. URL: https://koroseal.com/products/wallcoverings/sapphire/69184

E. WC-4B
   1. Distributor: Koroseal
   2. Manufacturer: Arte
   3. Pattern: Sapphire
   4. Color: 69193
   5. Width: 51”
   6. Content: Vinyl
   7. Location: First floor circulation and Locker room accent, refer to drawings.

8. Contact: Natalia Haywood natalia.haywood@koroseal.com
9. URL: https://koroseal.com/products/wallcoverings/sapphire/69193

F. WC-4C
1. Distributor: Koroseal
2. Manufacturer: Arte
3. Pattern: Sapphire
4. Color: 69190
5. Width: 52-54"
6. Content: Vinyl, Type II
7. Location: Circulation
8. Contact: Natalia Haywood natalia.haywood@koroseal.com
9. URL: https://www.arte-international.com/en/arte-contract/sapphire/67450

G. WC-5A
1. Manufacturer: MDC
2. Pattern: Chipper
3. Color: Fog
4. Product ID: Alpha6654
5. Width: 52”
6. Content: Fabric-backed vinyl
7. Location: Field at Barre, Pilates
8. Contact: Kellan Baker, kbaker@mdcwall.com Tel: 952-232-9642
9. URL: https://www.mdcwall.com/product/type-ii-wall/y46867ci

H. WC-8A
1. Manufacturer: Maharam
2. Pattern: Sari
3. Color: Goldenrod 025
4. Product ID: 399426
5. Width: 54”
6. Content: Non-Phthalate Vinyl
7. Location: LT Kids Academy – Gold Accent, Activity/Movement Studios and Learning Lab
8. Notes:
    a. Use PT-15 to paint access panels where VWC occurs. Refer to paint specs for info.
    b. Perforated Wallcovering - Minimum 30 yards and extra week to produce. Use at exterior walls only.
9. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116
10. URL: https://www.maharam.com/products/sari/colors/025-goldenrod

I. WC-8C
1. Manufacturer: Maharam
2. Pattern: Sari
3. Color: Lagoon 010
4. Product ID: 399426
5. Width: 54”
6. Content: Non-Phthalate Vinyl
7. Location: LT Kids Academy – Blue Accent - Toddler
8. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116
9. Note:
    a. Use PT-17 to paint access panels where VWC occurs. Refer to paint specs for info.
    b. Perforated Wallcovering - Minimum 30 yards and extra week to produce. Use at exterior walls only.
10. URL: https://www.maharam.com/products/sari/colors/010-lagoon

J. WC-8D

1. Manufacturer: Maharam
2. Pattern: Sari
3. Color: Amethyst 017
4. Product ID: 399426
5. Width: 54”
6. Content: Non-Phthalate Vinyl
7. Location: Purple accent, see drawings
8. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116
9. Note:
    a. Use PT-40 to paint access panels where VWC occurs. Refer to paint specs for info.
    b. Perforated Wallcovering - Minimum 30 yards and extra week to produce. Use at exterior walls only.
10. https://www.maharam.com/products/sari/colors/017-amethyst

K. WC-8E
1. Manufacturer: Maharam
2. Pattern: Sari
3. Color: Grass 006
4. Product ID: 399426
5. Width: 54”
6. Content: Non-Phthalate Vinyl
7. Installation: Stacked V
8. Location: LT Kids Academy see plans
9. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116
10. Note:
    a. Perforated Wallcovering - Minimum 30 yards and extra week to produce. Use at exterior walls only.
11. https://www.maharam.com/maharam/products/sari/colors/006-grass

L. WC-16
1. Manufacturer: Wolf Gordon
2. Pattern: Bespoke
3. Color: Fern
4. Product ID: BSP 2871
5. Width: 54"
6. Content: 100% Vinyl
7. Location: Cafe
8. Pricing Contact: Alfredo Ortiz; Alfredo.Ortiz@wolfgordon.com
9. Sales Representative: Jessica Nalipinski; Jessica.Nalipinski@wolfgordon.com
10. URL: https://www.wolfgordon.com/products/wallcovering/bespoke-bsp-2871

M. WC-22A
1. Manufacturer: Maharam
2. Pattern: Honor Weave – Custom
3. Color: New Earthen
4. Product ID: 012001/019
5. Width: 54”
6. Content: Vinyl
7. Location: Accent at Circulation
8. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116

N. WC-22B
1. Manufacturer: Maharam
2. Pattern: Honor Weave – Custom
3. Color: Coal
4. Product ID: Custom Life Time Product

5. Width: 54”
6. Content: Vinyl
7. Location: Circulation
8. Contact: Tracy Shand, tshand@maharam.com, 612-382-1116

O. WC-23
1. Manufacturer: Innovations
2. Pattern: Alchemy
3. Product Id: Alc-004
4. Color: Pale Silver
5. Width: 54"
6. Content: Fabric/ Vinyl
7. Install: Non Match
8. Note: Coordinating Paint Color Is TBD
9. Location:Reception Ceiling
10. Contact: Nancy Berge Morton, nancy@blendedblue.com
11. URL: https://www.innovationsusa.com/item/alchemy/alc-004

P. WC-24
1. Manufacturer: Maharam
2. Collection: Perch
3. Pattern:
4. Color: Hunter 019
5. Product ID: 399996
6. Width: 54”
7. Content: Vinyl
8. Location: Circulation
9. Pricing Contact: Alfredo Ortiz; Alfredo.Ortiz@wolfgordon.com
10. Sales Representative: Jessica Nalipinski; Jessica.Nalipinski@wolfgordon.com
11. URL: https://www.maharam.com/maharam/products/perch/colors/019-hunter

Q. WC-25
1. Manufacturer: Wolf Gordon
2. Collection: Ridgeline
3. Product ID: GOH 33251905
4. Color: Sand
5. Width: 52"
6. Content: 100% Vinyl
7. Note: Coordinating paint color is PT-27
8. Location: Pilates
9. Pricing Contact: Alfredo Ortiz; Alfredo.Ortiz@wolfgordon.com
10. Sales Representative: Jessica Nalipinski; Jessica.Nalipinski@wolfgordon.com
11. URL: https://www.wolfgordon.com/g/GOH+33251905

R. WC-26
1. Distributor: Koroseal
2. Manufacturer: Arte
3. Pattern: Lazur
4. Color: 67571
5. Width: 52”
6. Content: Vinyl
7. Location: Pilates
8. Contact: Natalia Haywood natalia.haywood@koroseal.com
9. URL: https://www.arte-international.com/en/arte-contract/lazur/67571

1.03 SCHEDULE OF FACEPLATE AND WIRING DEVICES COLORS BY WALL FINISH:

A. White faceplates are to be used on walls with the following finishes:
   1. WC-1
   2. WC-4C
   3. WC-5A
   4. WC-23
   5. WC-25

B. All other faceplates and wiring devices installed on wallcovering are to be black.

END OF SECTION

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SECTION 09 75 00
INTERIOR STONE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Stone countertops.
   2. Window stools.
   3. Benches.
   4. Wall caps.
   5. Soap dishes in shower.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 01 92 00 - Facility Operation and Maintenance.

F. Section 09 21 16 - Gypsum Board Assemblies.

G. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

H. Section 09 30 00 - Tiling.

I. Section 09 72 00 - Wall Coverings.

J. Section 09 75 01 - Interior Stone Schedules.

K. Section 09 84 30 - Sound Absorbing Wall and Ceiling Units.

L. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Each variety of stone.
   2. Stone installation materials and other manufactured products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification:
   1. For each stone type indicated, in sets of Samples not less than 12 inches (300 mm) square. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work. Samples will establish the standard by which stone will be judged.
   2. For each color of grout and sealant required.

D. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 7 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate interior stone similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

C. Installer Qualifications: Fabricator of interior stone.

D. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry, whether specified in this Section or in another Section, with resources to provide materials of consistent quality in appearance and physical properties.

E. Source Limitations for Other Materials: Obtain each type of grout, stone accessory, sealant, and other material through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.

B. Store stone on wood A-frames or pallets with non-staining separators and non-staining, waterproof covers. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.07 PROJECT CONDITIONS

A. Maintain air and material temperatures to comply with requirements of installation material manufacturers, but not less than 50 deg F (10 deg C) during installation and for 7 days after completion.

B. Field Measurements: Verify dimensions of construction to receive interior stone by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate installation of inserts that are to be embedded in concrete or masonry and similar items to be used by interior stone Installer for anchoring and supporting interior stone. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.

B. Time delivery and installation of interior stone to avoid extended on-site storage and to coordinate with work adjacent to interior stone.

PART 2 PRODUCTS

2.01 SEE ATTACHED SCHEDULE

2.02 SETTING MATERIALS

A. Adhesives, General: Use only adhesives formulated for stone and recommended by their manufacturer for the application indicated.

B. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Laticrete International, Inc.
    b. MAPEI Corp.
    c. Summitville Tiles, Inc.
    d. Akemi.

2.03 STONE ACCESSORIES

A. Vent Grommets: Doug Mockett & Company, 2-1/2” Air Vent Grommet Cap Set, Model # EDPAVG3, color: matte black, or similar.

B. Temporary Setting Shims: Rigid plastic shims, non-staining to stone, sized to suit joint thickness.

C. Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

D. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik Findley Inc.
      b. Custom Building Products.
      c. HMK Stone Care System.
      d. Stonecare International.
      e. Summitville Tiles, Inc.

2.04 STONE FABRICATION, GENERAL

A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
   1. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by Architect.

B. Fabricate interior stone in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
   1. For granite, comply with recommendations in NBGQA (SPEC) "Specifications for Architectural Granite."
   2. For limestone, comply with recommendations in ILI (HB) "Indiana Limestone Handbook."
   3. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.
   4. Where items are installed with adhesive or where edges of stone is visible in the finished work, make items uniform in thickness and of identical thickness for each type of item; gage back of stone if necessary.
   5. Clean sawed backs of stones to remove rust stains and iron particles.
   6. Dress joints straight and at right angle to face, unless otherwise indicated.
   7. Cut and drill sinkages and holes in stone for anchors, supports, and lifting devices as indicated or needed to set stone securely in place; shape beds to fit supports.
   8. Provide openings, reveals, and similar features as needed to accommodate adjacent work.

C. Finish exposed faces and edges of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples.

D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
   1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved Samples.

2.05 STONE COUNTERTOPS

A. General: Comply with recommendations in MIA (DM) "Dimension Stone - Design Manual."

B. Nominal Thickness: Provide thickness indicated, but not less than 1-1/4 inches (32 mm). Gage backs to provide units of identical thickness.

C. Edge Detail: 1-1/4 inch (20-mm) (3 cm) 1/8 inch eased at top and bottom edges.

D. Splashes: Provide 3/4-inch- (20-mm-) thick backsplashes and end splashes, unless otherwise indicated.

1. Height: 4 inches (100 mm).
2. Top-Edge Detail: Straight, slightly eased at corner.

E. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:
1. Color match stone epoxy all seams. Black at Verde Butterfly, Clear or Shaded at Santa Cecilia. 1/16 inch (1.5 mm) in width.

F. Cutouts and Holes:
1. Under-counter Fixtures: Make cutouts for under-counter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, under-counter soap dispensers, and similar items.

2.06 STONE WINDOW STOOLS

A. Window Stools:
1. Nominal Thickness: 1-1/4 inch (3 cm), unless otherwise indicated.
2. Edge Detail: 1/8 inch (10-mm) radius eased at top edge and polished back at underside – 2 inch min., bottom corner slightly eased.
3. Ends: Extend stools beyond opening same distance as stool overhang and finish ends to match exposed edge.
4. Joints: Bonded joints, Color match stone epoxy all seams. Black at Verde Butterfly, Clear or Shaded at Santa Cecilia. (1.5 mm) 1/32 inch (0.8 mm) or less in width.
5. Assemble window stools by bonding joints with stone adhesive. Mask areas adjacent to joints to prevent adhesive smears. Clamp units to temporary bracing to ensure that window stools are properly aligned and joints are minimum width.

2.07 STONE BENCHES

A. Tops:
1. Nominal Thickness: 1-1/4 inch (3 cm), unless otherwise indicated.
2. Edge Detail: 1/8 inch (10-mm) radius eased at top edge and polished back at underside – 2 inch min., bottom corner slightly eased.
3. Corner Detail: Match top edge.
4. Bottom Surface Finish: Smooth.

2.08 STONE WALL CAPS AND SOAP SHELVES

A. Tops:
1. Nominal Thickness: 1-1/4 inch (3 cm), unless otherwise indicated.
2. Edge Detail: 1/8 inch Radius Eased @ Top Edge
3. Corner Detail: Match top edge.
4. Bottom Surface Finish: Polish underside
5. Soap Shelf: 1/8 inch Radius Eased

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces indicated to receive interior stone and conditions under which interior stone will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.03 SETTING OF STONE, GENERAL

A. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping. Wet-cutting is preferred.

B. Contiguous Work: Provide reveals and openings as required to accommodate contiguous work.

C. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

D. Erect stone units level, plumb, and true with uniform joint widths. Use temporary shims to maintain joint width.

3.04 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.

B. Variation from Level: For lintels, sills, chair rails, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), 3/8 inch (10 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/16 inch (1.5 mm) or 1/4 of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/32-inch (0.8-mm) difference between planes of adjacent units.

3.05 INSTALLATION OF STONE COUNTERTOPS

A. General: Install countertops by adhering to supports with water-cleanable epoxy adhesive.

B. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships.

C. Space joints with 1/16-inch (1.5-mm) gap for filling with color match epoxy. Use temporary shims to ensure uniform spacing.

D. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. 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.

F. Install backsplash and end splash by adhering to wall with 100% silicone adhesive. Leave 1/16-inch (1.5-mm) gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.

3.06 INSTALLATION OF STONE WINDOW STOOLS AND CAPS

A. Stone Window Stools: Set stone window stools on tile backer board with thin set. Shim/clamp as needed until dry, remove shims, epoxy (color match) joints.

B. Where window stools are too long to be installed in one piece, assemble by bonding joints with stone adhesive as units are set. Mask areas adjacent to joints to prevent adhesive smears. Clamp units in place to ensure that window stools are properly aligned and joints are minimum width.

C. Stone Caps at Walls: Adhere units to tile backer or concrete masonry with 100% silicone adhesive. Shim/clamp as needed until dry, remove shims, epoxy (color match) joints.

3.07 INSTALLATION OF STONE BENCHES

A. Stone Bench Tops: Set stone bench tops on concrete or masonry bases in thin set. Shim/clamp as needed until dry, remove shims, epoxy (color match) joints.

3.08 JOINT-SEALANT INSTALLATION

A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants." Remove temporary shims before applying sealants.

3.09 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean interior stone as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.

B. Remove and replace interior stone of the following description:
   1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
   2. Defective stone.
   3. Defective joints, including misaligned joints.
   4. Interior stone and joints not matching approved Samples and mockups.
   5. Interior stone not complying with other requirements indicated.

C. Replace in a manner that results in interior stone's matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.

D. Clean interior stone no fewer than six days after completion of grouting and pointing, using clean water and soft rags or stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions and recommendations.

3.10 PROTECTION

A. Protect stone surfaces, edges, and corners from construction damage. Use securely fastened untreated wood, plywood, or heavy cardboard to prevent damage.

B. Before inspection for Substantial Completion, remove protective coverings and clean surfaces.

END OF SECTION

SECTION 09 75 01
INTERIOR STONE - SCHEDULE

PART 2 PRODUCTS

1.01 GRANITE

A. Cut stone from contiguous, matched slabs in which natural markings occur.

B. Granite: Comply with ASTM C615.

C. STN-1:
1. Manufacturer: Daltile
2. Color: Verde Butterfly
3. Thickness: 1-1/4", 3 cm
4. Finish: Polished
5. Nosing: Eased Edge- 1/8 inch radius eased at top and bottom
6. Location: Non-member facing offices, Locker room benches, towel drops and soap shelves.
7. Contact: Amy McMacken, 734.218.4995, amy.mcmacken@daltile.com
8. URL: http://daltilestonecenter.com/StGeorge/ProductDetail.aspx?ID=682

D. STN-1A:
1. Manufacturer: Daltile
2. Color: Verde Butterfly
3. Thickness: 3/4", 2 cm
4. Finish: Polished
5. Nosing: Eased Edge- 1/8 inch radius eased at top and bottom
6. Location: Vanity Skirts, Backsplashes, Towel Shelves.
7. Contact: Amy McMacken, 734.218.4995, amy.mcmacken@daltile.com
8. URL: http://daltilestonecenter.com/StGeorge/ProductDetail.aspx?ID=682

E. STN-15:
1. Manufacturer: Daltile
2. Color: Biscotti White G7777
3. Thickness: 3cm, 1 ¼"
4. Finish: Polished
5. Nosing: Eased Edge
6. Location: Stone throughout, refer to drawings.
7. URL: https://www.daltile.com/products/stone/granite-+-natural-stone-slab/slab/biscottiwhite/polished/standard

F. STN-15A:
1. Manufacturer: Daltile
2. Color: Biscotti White G7777
3. Thickness: 2cm, ¾"
4. Finish: Polished
5. Nosing: Eased Edge
6. Location: Vanity skirts, Backsplashes as required.
7. URL: https://www.daltile.com/products/stone/granite-+-natural-stone-slab/slab/biscottiwhite/polished/standard

END OF SECTION

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SECTION 09 77 50
VERTICAL SURFACING PANEL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior Metal Panels and/or Sheets.
   2. Extruded Trim.
   3. Installation Accessories.
   4. All labor and material for a complete and acceptable installation.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 09 21 16 - Gypsum Board Assemblies.

F. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

G. Section 09 75 00 - Interior Stone.

H. Section 09 84 30 - Sound Absorbing Wall and Ceiling Units.

I. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. Standards:
   1. Aluminum Trim: ASTM B209.
   2. Medium Density Fiberboard Substrate: ANSI A208.2.
   3. Particle Board Substrate: ANSI A208.1.
   4. Adhesive Composition: ASTM C916 Type II, NFPA 90A/90B.
   5. Adhesive Surface Burning Characteristics: ASTM E84.
   6. Topcoat Pencil Hardness: ASTM D3363.
   7. Topcoat Crockmeter Scratch: SAE J861.
   8. Topcoat Taber Abrasion: ASTM D4060.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Include the following:
      a. Dimensioned lay-out all of the panels.
      b. Dimensioned lay-out of all of the trim.
      c. Dimensioned lay-out of all of the mounting accessories.

B. Product Data:
   1. Descriptive Literature: Fully describing the cast panel and accessories that include the following.
      a. Metal Particles.
      b. Top Coat.
      c. Substrate.
      d. Extruded Trim.
      e. Installation Accessories.
      f. Maintenance Instructions.
   2. Installation Instructions.
   3. Adhesive Material Safety Data Sheets.

C. Samples:

1. Provide three 6 inch square samples of each GageMetal® sheet and/or panel with respective substrate, edge detail, pattern and background material and color reflecting anticipated color range of finished product.
2. Provide three 6 inch long samples of each extruded trim type, material and color reflecting anticipated color range of finished product.

D. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

E. Closeout Submittals:
1. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Pre-Installation Meetings:
1. Go through installation procedure with factory trained personnel at the job site. Applicator, Contractor, and/or Architect to attend.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:
1. Protect from excessive moisture.
2. Deliver in unopened packaging clearly marked as to panel, extruded trim and accessory included. For panels, extruded trim indicate type, size, color and pattern.
3. Do not deliver until all wet work is complete and cured.
4. Leave protective cover sheet film in place until final installation.

B. Acceptance at Site:
1. Immediately inspect upon delivery.
2. Verify that packaging is not damaged and that all materials have been received and are correct and undamaged.
3. Place in climate controlled warehouse prior to delivery to site.

C. Storage and Protection:
1. Store products in an area where finished space ambient temperature occurs for at least 48 hours prior to installation.
2. Protect panel edges from damage.
3. Store panel/sheet containers flat.

1.07 PROJECT/SITE CONDITIONS

A. Existing Conditions:
1. Field verify substrate dimensions and readiness for installation. Adjust installation process accordingly.

PART 2 PRODUCTS

2.01 INTERIOR METAL SHEET AND PANEL MATERIALS

A. Manufacturer:
1. See schedule below.

B. Substrate:
1. As indicated by panel type.

C. Finish:
1. See schedule below.

D. Pattern:
1. Selective. Overall mechanical finish per design.

2.02 PANEL SCHEDULE:

A. MP-5
1. Manufacturer: Pure+Freeform
2. Series: Architectural Metal Wall
3. Product: Old Dirty Bronze #FA-023
4. Sheet Size: 48" x 120"
5. Thickness: 12 Gauge (.8mm)
6. System: Flush Panel System - See Manufacturer's details
7. Installation: Horizontal
8. Location: Cafe Entry
9. Contact: Will Pilkington 612 384-1998
10. URL: https://purefreeform.com/portfolio-item/black-gold/old-dirty-bronze/

B. MP-6
1. Manufacturer: The Gage Corporation.
2. Distributer: Koroseal
3. Product: Gage Vertical Surfacing GM438 BLK2 long grain satin black PVD W/FRC.
4. Sheet Size: 48" x 120"
5. Thickness: 16 Gauge (1.5mm)
6. System: Laminated to 1/2" fiberglass honeycomb structural panel (nida-core). Aluminum French cleat hanger - attach to honeycomb panel w/epoxy set sunk-nut
7. Location:Reception Feature Wall
8. Contact: Sondra Carlson; scarlson@koroseal.com
9. URL: https://www.gagecorp.net/wp-content/uploads/GageMetal-PVD-Flyer_072222.pdf

C. MP-8
1. Manufacturer: Alucobond
2. Product: Alucobond Plus ACM Hairline Panel System.
3. Color: Brushed Carbon
4. Sheet Size: 48" x 120"
5. Thickness: 8 Gauge (4mm)
6. System: Aluminum Composite Panel: .020" nom thickness aluminum face on fire retardant core.
7. Location: See Drawings.
8. Contact: Mike Herbst: mherbst@ebpmn.com
9. URL: https://www.alucobondusa.com/product/alucobond-plus/

2.03 EQUIPMENT

A. Installation Tools: As required by manufacturer’s printed installation instructions.

2.04 COMPONENTS

A. Extrusions: 0.100 inch extruded aluminum for extrusion base, .060 inch extruded aluminum for extrusion legs and splines, ASTM B209, 6063/T5 alloy, 0.4MIL clear anodized finish, of configurations as shown on the drawings.
1. Aluminum Z Clips Fastened to Honeycomb panels w/ backnut & bolt.
2. Other Fasteners: Of material, size and spacing as recommended by the manufacturer.

2.05 ACCESSORIES

A. Trim: Where indicated on drawings and by installation system, install manufacturer's standard trim.

B. Use either of the two options. Consult with the factory as to other acceptable contact adhesives.
1. Adhesive: Foster Products, a Division of H. B. Fuller, Inc., “Quick-Tack™ 85-60” water base, asbestos free, low VOC cream adhesive; (800) 338-2975.
a. Burning Characteristics.
1) Flame Spread: 0.

2) Smoke Development: 0.

2. Adhesive: Any standard solvent-based contact cement.
   a. Adhesive shall be of the type as recommended by industry standards for end use application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions:
   1. Examine substrates with installer present.

B. Verify compliance with requirements for installation tolerances and other conditions affecting final installation.

C. Proceed only after all defects have been corrected.

3.02 INSTALLATION

A. Acclimatize panels and trim within installation area 48 hours prior to installation.

B. Install panels at locations indicated with vertical surfaces and edges plumb, horizontal edges level and in alignment with other panels. Scribe panels to fit adjacent work.
   1. Adhesive Application (System “A”): Refer to manufacturer’s printed installation instructions.
   2. Fasteners shall engage studs. Coordinate panel size selection with stud spacing. The use of a continuous layer of 1/2 inch plywood over the studs before the application of the wall substrate surface will allow for more flexibility in panel size selection.
   3. Verify stud spacing and coordinate accordingly to ensure engagement of fasteners into studs.
   4. Extrusion Application (System “E”): Refer to manufacturer’s printed installation instructions.

C. If joint intersections are required to be non-interrupted, consult with the factory.
   1. Joint Configuration: Hairline butt joints with recess intersection interrupted.

D. Main Runners and Perimeter Trim: Factory notched at intersections.
   1. Fasteners shall engage studs. Coordinate panel size selection with stud spacing. The use of a continuous layer of 1/2 inch plywood over the studs before the application of the wall surface will allow for more flexibility in panel size selection.
   2. Verify stud spacing and coordinate accordingly to ensure engagement of fasteners into studs.

E. Variation From Plumb: Plus or minus 1/8 inch.

F. Variation of Joints From Hairline: Less than 1/8 inch.

3.03 CLEANING

A. Clean panels, in accord with manufacturer’s printed instructions. Contractor to replace panels at no additional cost that cannot be properly cleaned to the satisfaction of the Architect.

3.04 PROTECTION

A. Protect installation until final completion of the Project. Contractor to replace damaged components at no additional cost in a manner approved by the Architect.

END OF SECTION

SECTION 09 84 30
SOUND ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing ceiling baffles.

B. Sound-absorbing decorative felt wall surface.

C. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 09 21 16 - Gypsum Board Assemblies.

E. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

F. Section 09 51 13 - Acoustic Panel Ceilings.

G. Section 09 75 00 - Interior Stone.

H. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type and color of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Manufacturer's Qualification Statement.

H. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Construction Manager within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

I. Maintenance Materials: Furnish the following for Operator's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

C. See Seismic requirements for Suspended Ceilings in Section 09 51 13.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 SOUND-ABSORBING BAFFLES

A. B-4
   1. Basis of Design:
      a. Manufacturers: CSI Creative
   2. Product ID: Custom Baffles
   3. Acoustics: 0.75-0.95 NRC
   4. Flammability: ASTM E84: Class A.
   5. Material: Soundcore® 100 percent recyclable 12mm PET, 60 percent recycled content.
   6. Color: Abalone SND131
   7. Panel Size: 10’ L x 1” T x 10” H, typical - Refer to RCP for specific lengths
   8. Patterns: As indicated on Drawings
   9. Spacing: 14" OC
   10. Installation: Rail suspension by manufacturer.
      a. CSI substrate clad linear system with No. 1 cable
      b. Soundcore on support rail to be SND037 Paper.

2.02 SOUND ABSORBING DECORATIVE FELT WALL SURFACE

A. Acceptable Manufacturer: CSI Creative.
   1. Location: 9901 W 74th St, Eden Prairie, MN 55344
   2. Phone: 800-213-0653
   3. Email: info@csicreative.com
   4. Web Address: www.csicreative.com
   5. Substitutions: No substitutions permitted.

B. Product:
   1. Series: Line Surfaces 7
   2. Product Number: SUR-LNE-007
   3. Materials
      a. Surface Felt: PoshFelt® 100 percent wool 3mm design felt, 100 Percent Biodegradable.
      b. Acoustic Substrate: Soundcore® 100 percent recyclable 12mm PET, 60 percent recycled content.
   4. Colors:
      a. Green: Cove SND137
      b. White: Paper SND037
      c. Blue: Tidal SND139
   5. Mounting: Z-clip method by Manufacturer.
   6. See Drawings for configuration.
   7. Properties:
      a. Acoustic Performance: NRC (ASTM C423): 0.45 - 1.55 varies
      b. Burning Characteristics: ASTM E-84 Class A

2.03 FABRICATION

A. Fabricate panels to sizes and configurations as indicated, with facing installed without sagging, wrinkles, blisters, or visible seams.
   1. For panels suspended from ceiling, provide facing covering both sides, with seams only at panel edges.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.04 ACCESSORIES

A. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.

B. Z-Clips: As provided by felt panel manufacturer.
   1. Provide Z-clip anchors as necessary for substrate.

C. Fixing Clips: Manufacturers standard for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Suspend sound absorbing units at locations and heights as indicated.

C. Attach Z-clips to wall surfaces with anchors appropriate to the substrate according to the Manufacturer's recommendations.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
   1. Plumb and level.
   2. Flatness.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 91 01
PAINTING - SCHEDULES

PART 1 GENERAL

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 PAINT SCHEDULE

A. PT-1
   1. Manufacturer: Benjamin Moore
   2. Color: OC-24 Winds Breath
   3. Finish: By Surface
   4. Location: General Ceiling, Soffits unless otherwise specified, Gyms Above AWC, Pools, Back of House (BOH), Exposed Ducts at Gyms, Access Panels, See Schedule.
   5. Notes: Color Preview Collection
   6. URL: https://www.benjaminmoore.com/en-us/color-overview/find-your-color/color/oc-24/winds-breath?color=OC-24

B. PT-2
   1. Manufacturer: Sherwin Williams
   2. Color: SW 7038 Tony Taupe
   3. Finish: By Surface
   4. Location: Door Frames, Exterior Metal-Door Frames, Bistro, Trash Enclosure, Access Panels; see schedule
   5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7038-tony-taupe

C. PT-3
   1. Manufacturer: Benjamin Moore
   2. Color: HC-110 Wethersfield Moss
   3. Finish: By Surface
   4. Location: See Drawings
   5. URL: https://www.benjaminmoore.com/en-us/color-overview/find-your-color/color/hc-110/wethersfield-moss?color=HC-110

D. PT-4
   1. Manufacturer: Sherwin Williams
   2. Color: SW 7037 Balanced Beige
   3. Finish: By Surface
   4. Location:See Drawings, Access Panels; see schedule
   5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7037-balanced-beige

E. PT-5
   1. Manufacturer: Sherwin Williams
   2. Color: SW 0038 Library Pewter
   3. Finish: By Surface
   4. Location: Gym Basketball Supports
   5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW0038-library-pewter

F. PT-6
   1. Manufacturer: Sherwin Williams
   2. Color: SW 7020 Black Fox
   3. Finish: By Surface
   4. Location: Door Frames at Spa, Yoga, Exterior Awning, Access Panels; see schedule

5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7020-black-fox

G. PT-7
1. Manufacturer: Sherwin-Williams.
2. Color: SW 6991 Black Magic
3. Finish: By Surface
4. Location: : Desk Legs, Behind Mirrors, Pockets, Access Panels; see schedule
5. Notes: Macropoxy 646-100 – (2) Coats based on manufacturers recommendation at desk legs
6. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW6991-black-magic

H. PT-8
1. Manufacturer: Sherwin Williams
2. Color: SW 7642 Paverstone
3. Finish: By Surface
4. Location: Access Panels; see schedule.
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7642-pavestone

I. PT-10
1. Manufacturer: Scuff master/Wolf Gordon
2. Color: WG 5854214
3. Finish: Solid Metal
4. Location: See drawings, Access Panels; see schedule

J. PT-12
1. Manufacturer: Sherwin Williams
2. Color: SW 7695 Mesa Tan
3. Finish: By Surface
4. Location: Pool IFS, Door frames at pools
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7695-mesa-tan

K. PT-14
1. Manufacturer: Sherwin Williams
2. Color: SW 7036 Accessible Beige
3. Finish: By Surface
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7036-accessible-beige

L. PT-15
1. Manufacturer: Sherwin Williams
2. Color: SW 6389 Butternut
3. Finish: By Surface
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW6389-butternut

M. PT-17
1. Manufacturer: Sherwin Williams
2. Color: SW 6494 Lakeshore.
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW6494-lakeshore

N. PT-18

1. Manufacturer: Benjamin Moore
2. Color: OC-61 White Diamond.
3. Finish: By Surface.
4. Location: White per drawings.
5. URL: https://www.benjaminmoore.com/en-us/color-overview/find-your-color/color/oc-61/white-diamond?color=OC-61

O. PT-19
1. Manufacturer: Sherwin Williams
2. Color: SW 4084 Safety Yellow
3. Finish: By Surface
4. Location: Safety Yellow, Ramps / Exterior/ Sump Basin Lids and Covers
5. URL: https://www.myperfectcolor.com/paint/75023-sherwin-williams-sw4084-safety-yellow

P. PT-20
1. Manufacturer: Benjamin Moore
2. Color: HC-21 Huntington Beige.
3. Finish: By Surface
4. Location: Architectural Precast Spandrel / Cornice.
5. URL: https://www.benjaminmoore.com/en-us/color-overview/find-your-color/color/HC-21/huntington-beige?color=HC-21

Q. PT-22
1. Manufacturer: Sherwin Williams
2. Color: SW 6186 Dried Thyme
3. Finish: By Surface
4. Location: LT Work – Painted Millwork, Wood Panel Doors
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW6186-dried-thyme

R. PT-23
1. Manufacturer: Sherwin Williams
2. Color: SW 7047 Porpoise
3. Finish: By Surface
4. Location: LT Work – Nook Ceiling, Group Studio Soffit, Access Panels; see schedule.
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7047-porpoise

S. PT-24
1. Manufacturer: Sherwin Williams
2. Color: SW 6187 Rosemary
3. Finish: By Surface
4. Location: LT Work – Restroom Ceiling, Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW6187-rosemary

T. PT-26
1. Manufacturer: Sherwin Williams
2. Color: SW 7042 Shoji White
3. Finish: By Surface
4. Location: LT Work – Ceiling (Field)
5. URL: https://www.sherwin-williams.com/homeowners/color/find-and-explore-colors/paint-colors-by-family/SW7042-shoji-white

U. PT-28A
1. Manufacturer: Scuffmaster
2. Color by application:
    a. Spray: SM8150

b. Brush and Roll: GOH 32067893/EM8150R
3. Finish: As indicated above.
4. Location: See Drawings

V. PT-29
1. Manufacturer: Scuffmaster
2. Color: Solid Metal GOH 31664789
3. Finish: Solid Metal
4. Location: Stair Stringer, Riser and Handrail

W. PT-30
1. Manufacturer: Sherwin Williams
2. Color: Dull Orange, Custom Color to Match Pantone 158C
3. Finish: By Surface.
4. Notes: Custom Pantone 158C (Orange)
5. URL: https://www.pantone.com/color-finder/158-C

X. PT-31
1. Manufacturer: Sherwin Williams
2. Color: Custom Color to Match Pantone 7C Gallon Color Cast
3. Finish: By Surface.
4. Notes: Custom Pantone 7C (Black)
5. URL: https://www.pantone.com/color-finder/black-7-C

Y. PT-32
1. Manufacturer: Sherwin Williams
2. Color: Custom Color to Match Pantone 2C Warm Gray
3. Finish: By Surface
4. Notes: Custom Pantone 2 (Gray)
5. URL: https://www.pantone.com/color-finder/Warm-Gray-2-C

Z. PT-33
1. Manufacturer: Sherwin Williams
2. Color: Custom Color to Match Pantone 7527
3. Finish: By Surface.
4. Notes: Custom Pantone 7527

AA. PT-34
1. Manufacturer: Sherwin Williams
2. Color: SW 7048 Urbane Bronze
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW7048-urbane-bronze

BB. PT-35
1. Manufacturer: Sherwin Williams
2. Color: SW 7068 Grizzle Gray
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW7068-grizzle-gray

CC. PT-37
1. Manfacturer: Benjamin Moore
2. Color: Antique Pewter 1560
3. Finish: By Surface.
4. Location: ceilings/soffits

5. URL: https://www.benjaminmoore.com/en-us/paint-colors/color/1560/antique-pewter

DD. PT-38
1. Manufacturer: Benjamin Moore
2. Color: Oak Grove 489
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. URL: https://www.benjaminmoore.com/en-us/paint-colors/color/489/oak-grove

EE. PT-39
1. Manufacturer: Sherwin Williams
2. Color: SW 2809 Rookwood Shutter Green
3. Finish: By Surface.
4. Location: Pickleball
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/green-paint-colors/SW2809-rookwood-shutter-green

FF. PT-40
1. Manufacturer: Sherwin Williams
2. Color: SW 6839 Kimono Violet
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/purple-paint-colors/SW6839-kimono-violet

GG. PT-42
1. Manufacturer: Sherwin Williams
2. Color: SW 6103 Tea Chest
3. Finish: By Surface.
4. Location: See drawings.
5. URL: https://protect-usb.mimecast.com/s/KehECQAr18H72Xv8FQABqI?domain=sherwin-williams.com

HH. PT-43
1. Manufacturer: Scuffmaster
2. Distributer: Wolf Gordon
3. Series: Solid Metal
4. Color: WG 7613613
5. Finish: Burnished Metallic
6. Location: See drawings.
7. URL: Custom color, no link.

II. PT-46
1. Manufacturer: Sherwin Williams
2. Color: SW 7649 Silverplate
3. Finish: By Surface.
4. Location: Access Panels; see schedule
5. https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW7649-silverplate

JJ. PT-47
1. Manufacturer: Scuffmaster
2. Color: BR10299
3. Finish: Burnished Metallic
4. Location: See drawings.
5. URL: https://www.scuffmaster.com/explore-colors/#?tags=BR10299

KK. EPT-48

1. Manufacturer: Sherwin Williams
2. Color: SW7039 Virtual Taupe
3. Finish: Semi
4. Location: See drawings.
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW7039-virtual-taupe

LL. EPT-49
1. Manufacturer: Sherwin Williams
2. Color: SW7506 Loggia
3. Finish: Semi-Gloss
4. Location: See drawings.
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW7506-loggia

MM. EPT-50
1. Manufacturer: Sherwin Williams
2. Color: SW9174 Moth Wing
3. Finish: Semi-Gloss
4. Location: See drawings.
5. URL: https://www.sherwin-williams.com/en-us/color/color-family/neutral-paint-colors/SW9174-moth-wing

3.02 POWDER COATING SCHEDULE

A. PCC-13:
1. Manufacturer: Prismatic Powders
2. Product: PMB-1808
3. Color: Performance Gold
4. Location: Metal, See Drawings.
5. https://www.prismaticpowders.com/shop/powder-coating-colors/PMB-1808/performance-gold

B. PCC-14:
1. Manufacturer: Tiger Drylac
2. Product: 138/60080
3. Color: Statuary Bronze
4. Location: Metal, See Drawings.
5. URL: www.tiger-coatings.com/us-en/products/tiger-drylacr-products#/show/38-60080?gclid=Cj0KCQjw06OTBhC_ARIsAAU1yOVA5Cmya_7tAbGmcgcYQYHgzcHlF3ywkCc8O_EKTqWJkKBTtr4tTRsaAskgEALw_wc

C. PCC-16:
1. Manufacturer: Prismatic Powders
2. Product: PMB-2749 / Metallic
3. Color: Black Bronze II
4. Location: Metal, See Drawings. Matches Dark Bronze hardware
5. URL: https://www.prismaticpowders.com/shop/powder-coating-colors/PMB-2749/black-bronze-ii

D. PCC-17:
1. Manufacturer: Sherwin Williams
2. Product: Powdura Polyester TGIC Powder Coating
3. Product #: PDS4-C0014
4. Color: Architectural Bronze
5. Location(s): Site Fencing, Trash Enclosure Gate

3.03 SCHEDULE OF PAINT COLORS FOR ACCESS PANELS BY WALL FINISH

A. Tile:
1. TL-15: PT-6

2. TL-22: PT-4
3. TL-51: PT-14
4. TL-52: PT-2
5. TL-53: PT-5
6. TL-55: PT-23
7. TL-61: PT-4
8. TL-62: PT-35
9. TL-77: PT-14

B. Wall Coverings:
1. WC-1: PT-2
2. WC-4A: >1 sq. ft.= PT-28A, <1 sq. ft. = PT-23
3. WC-4B: >1 sq. ft. = PT-10, <1 sq. ft. = PT-8
4. WC-4C: PT-4
5. WC-5A: PT-4
6. WC-8A: PT-15
7. WC-8C: PT-17
8. WC-16: PT-24
9. WC-23: PT-46
10. WC-25: PT-27
11. WC-26: PT-1

3.04 SCHEDULE OF FACEPLATE AND WIRING DEVICES COLORS BY WALL FINISH:

A. White faceplates and devices are to be used on walls with the following finishes:
1. PT-1
2. PT-4
3. PT-14
4. PT-18
5. PT-26
6. PT-46

B. All other faceplates and wiring devices installed on painted walls are to be black.

END OF SECTION

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SECTION 10 00 10
DIVISION 10 TABLE OF CONTENTS

DIVISION 10 – SPECIALTIES

10 14 00 - Signage
10 21 13.16 - Plastic Laminate Clad Toilet Compartments
10 22 36 - Coiled Wire Fabric and Attachment Systems
10 28 13 - Toilet and Bath Accessories
10 28 19 - Glass Shower Doors
10 44 00 - Fire Protection Specialties

END OF SECTION

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SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Driveway, Parking Lot and Traffic Signage.
   2. Exterior Signage.
   3. Interior Signage.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast-in-Place Concrete.

E. Section 04 20 00 - Unit Masonry.

F. Section 05 50 00 - Metal Fabrications.

G. Section 07 24 00 - Exterior Insulation and Finish System.

H. Section 07 92 00 - Joint Sealants.

I. Section 09 91 00 - Painting.

1.03 REFERENCES

A. Standards of the following as referenced:
   1. Aluminum Association (AA)
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
   3. American National Standards Institute (ANSI)
   4. American Society for Testing and Materials (ASTM)
   5. Manual on Uniform Traffic Control Devices (MUTCD)
   6. Underwriters' Laboratories, Inc. (UL)

1.04 SUBMITTALS

A. Product data: for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles and finishes.

B. Shop drawings: identifying all materials, sizes, construction details, graphics layout, type style specifications and mounting methods showing fabrication and attachment of signs. Include plans, elevations and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories and installation details.
   1. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
   2. For signs supported by or anchored to permanent construction, provide setting drawings, templates and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
   3. If required by the state, all exterior signage anchorage to be designed by a professional engineer registered by the state. Submit signed and sealed anchor details to architect for approval.
   4. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

C. Signage Schedule: Complete with the location of each sign and the required copy/text.

D. Wiring diagrams from the manufacturer for illuminated sign units must be submitted to for approval. Include the following:
   1. Proposed LED configuration and layout within each letter and cabinet.

2. Quantity of modules per letter and cabinet.
3. Power supply quantities, locations and loads.

E. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those required for this Project, with a record of successful in-service performance and sufficient production capacity to produce sign units without causing delay in the Work.

C. UL and NEMA Compliance: Provide sign lighting fixtures and electrical components for illuminated signs that are labeled and listed by UL and comply with applicable NEMA standards.

D. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.06 PERFORMANCE REQUIREMENTS

A. Provide signage that conforms to the requirements of regulatory agencies holding jurisdiction.

B. Products shall meet the current requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications. All signage to comply with ADAAG provisions for signage, at appropriate locations, with respect to the following:
1. Character proportion.
2. Character height.
3. Raised and braille characters.
4. Pictorial symbols.
5. Finish and contrast.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Division 1.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.

E. Handle products in accordance with manufacturer's instructions.

1.08 WARRANTY

A. Project Warranty: Comply with requirements of Division 1.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
1. Warranty Period:
a. LEDs: 5 year parts and labor warranty.
b. LED power supplies: 5 year parts and labor warranty.

PART 2 PRODUCTS

2.01 SIGN MATERIALS: DRIVEWAYS, PARKING LOTS AND RAMPS

A. Manufacturers: Subject to compliance with requirements, provide products as specified and shown on drawings.

B. Traffic Control Signage: All traffic control signs must comply with the latest requirements per MUTCD. See Civil drawings for schedules, locations and details.

2.02 SIGN MATERIALS: EXTERIOR BUILDING FACADES & POOL AREAS

A. Manufacturers: Subject to compliance with requirements, provide products as specified and shown on drawings.

B. Halo-Illuminated Channel Letters – LIFE TIME Sign.
   1. Letter Type: Reverse pan channels with halo illumination.
   2. Interior of channel letters shall be painted white or coated with reflective 3M film.
   3. Depth: 3” or as shown on drawings.
   4. Faces:
      a. “LIFE” = .090” Aluminum w/80 grit vertical brushed finish.
      b. “TIME” = .090” Aluminum w/80 grit vertical brushed finish.
   5. Backs: .150” clear Lexan w/riveted angle clips for face/return attachment.
   6. Returns: .090” Aluminum.
   7. Color: Shine seal finish.
   8. Mounting: Mount to exterior substrate with 2” spacers and anchors as required.
   9. Illumination: White LEDs:
      a. Manufacturers:
         1) Samsung.
         2) GE.
         3) Principal.
         4) Approved equivalent.
      b. LED requirements:
         1) Color Temp: 7,000K.
         2) Wet location rated.
         3) (3) LEDs per module.
         4) Minimum 90 lumens per foot or as required to provide adequate illumination. Illumination determined based on size of object and reflectance of supporting wall.
   10. Power: Power supplies to be dual rated for 120/277V and not be loaded more than 75% of the rated power supply capacity. Provide integral disconnect switch accessible to technician without entering cabinet.

C. Halo-Illuminated Channel Letters - LIFE CAFÉ & LIFE SPA Signs.
   1. Letter Type: Reverse pan channels with halo illumination.
   2. Interior of channel letters shall be painted white or coated with reflective 3M film.
   3. Depth: 2” or as shown on drawings.
   4. Faces:
      a. “LIFE” = .090” Aluminum w/80 grit vertical brushed finish.
      b. “CAFE” & “SPA”= .090” Aluminum w/80 grit vertical brushed finish.
   5. Backs: .150” clear Lexan w/riveted angle clips for face/return attachment Returns: .063” aluminum.
   6. Returns: .090” Aluminum.
   7. Color: Shine seal finish.
   8. Mounting: Mount to substrate with 2” spacers and anchors as required.
   9. Illumination: White LEDs:
      a. Manufacturers:
         1) Samsung.
         2) GE.
         3) Principal.
         4) Approved equivalent.
      b. LED requirements:
         1) Color Temp: 7,000K.
         2) Wet location rated.

3) (3) LEDs per module.
4) Minimum 90 lumens per foot or as required to provide adequate illumination. Illumination determined based on size of object and reflectance of supporting wall.

10. Power: Power supplies to be dual rated for 120/277V and not be loaded more than 75% of the rated power supply capacity. Provide integral disconnect switch accessible to technician without entering cabinet.

D. Illuminated LOGO – LIFE CAFÉ & LIFE SPA Signs.
1. Cabinet: Lighted Box Cabinet.
2. Depth: 2” or as shown on drawings.
3. Face: 3/16” translucent white acrylic.
4. Back: .063” aluminum w/riveted angle clips for face/return attachments.
5. Returns: .063” aluminum.
6. Logo: 3/16” flat cut-out aluminum, painted P.T.M. MAP “Black.”
7. Color (returns): P.T.M. MAP “Black.”
8. Illumination: Internal White LEDs:
   a. Manufacturers:
      1) Samsung.
      2) GE.
      3) Principal.
      4) Approved equivalent.
   b. LED requirements:
      1) Color Temp: 7,000K.
      2) Wet location rated.
      3) (3) LEDs per module.
      4) Minimum 90 lumens per foot or as required to provide adequate illumination. Illumination determined based on size of object and reflectance of supporting wall.
9. Power: Power supplies to be dual rated for 120/277V and not be loaded more than 75% of the rated power supply capacity. Provide integral disconnect switch accessible to technician without entering cabinet.
10. Mounting: Mount to substrate as required and shield fasteners though frame stand-offs as required. Provide galvanized screws as required at exterior substrates.

E. Halo illuminated Channel Letters: LIFE TIME PICKLEBALL.
1. Letter Type: Reverse pan channels with halo illumination.
2. Interior of channel letters shall be painted white or coated with reflective 3M film.
3. Depth: 3” or as shown on drawings.
4. Stand offs: 2" min from face of wall to back of letter.
5. Faces:
   a. “LIFE TIME” = .125” Anodized Aluminum w/80 grit vertical brushed finish and clear coat.
   b. “Pickleball” and Logo = .125” Anodized Aluminum w/80 grit vertical brushed finish painted to match Pantone PMS 2995 Blue.
6. Returns:
   a. .080 x 3" Anodized Aluminum. Finish to match face.
7. Backs: .150” clear Lexan w/riveted angle clips for face/return attachment Returns: .063” aluminum.
8. Illumination: Internal White LEDs:
   a. Manufacturers:
      1) Samsung.
      2) GE.
      3) Principal.
      4) Approved equivalent.
   b. LED requirements:
      1) Color Temp: 7,000K.
      2) Wet location rated.

3) Minimum 90 lumens per foot or as required to provide adequate illumination. Illumination determined based on size of object and reflectance of supporting wall.

9. Power: Power supplies to be dual rated for 120/277V and not be loaded more than 75% of the rated power supply capacity. Provide integral disconnect switch accessible to technician without entering cabinet.
10. Mounting: Mount to substrate as required and shield fasteners though frame stand-offs as required. Provide galvanized screws as required at exterior substrates.

F. Address: Non-Illuminated Address F.C.O.
1. Type: Flat cut-out.
2. Faces: ¼" aluminum w/80 grit vertical brushed finish on faces.
3. Returns: ¼" aluminum with natural aluminum finish.
4. Numbers: As shown on drawings and/or as provided by owner.
5. Color: Shine seal finish.
6. Illumination: Non-illuminated.
7. Mounting: Mount flush to wall substrate with ¼" x 4" studs and Hilti injectable mortar as required.

2.03 SIGN MATERIALS: INTERIOR

A. Interior signage to be furnished by Owner or by Manufacturer of related equipment.
1. Contractor to coordinate blocking, electrical, and other requirements with details and Signage Provider.

2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish hot-dip galvanized devices unless otherwise indicated.
3. Sign Mounting Fasteners:
a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
4. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated per 40 CFR 59, Subpart D (EPA Method 24).

2.05 FINISHES

A. Colors and Surface Textures: For exposed sign that require 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 Owner from manufacturer's full standard color range.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Class II Clear Anodized Fine Satin Finish: AA-M31C21A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Fine matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions including for correct location of cast-in anchor installed under other section.

B. Notify Architect in writing of unacceptable substrate or improper anchor location(s).

C. Scheduling of installation by Owner or it's representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer's acceptance of substrate and acceptance of substrate and conditions.

3.02 INSTALLATION

A. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
   a. Install product level, plumb, and at heights indicated.
   b. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.
   c. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
      1) Interior Signs: Within 1/4 inch vertically and horizontally of intended location.

B. Halo - Illuminated Signs.
   1. Channel letters:
      a. Reverse pan channel letters with halo illumination.
      b. LED modules to wrap letters in continuous rows approximately 1.5" off edge; spacing to be approximately 3" on center between modules; closer as required to achieve uniform halo.
      c. Mount to clear lexan back pointed toward letter front to allow for double bounce of light.
      d. Install reflective backing on wall of building behind each letter.
   2. Cabinet:
      a. Reverse pan channel cabinet with halo illumination and face illuminated text graphics.
      b. LED modules to run in straight line, parallel with top and bottom of cabinet, spacing to be approximately 3" on center between modules and 6" on center between rows. Spacing should be modified as needed to achieve uniform illumination.

C. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
   1. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
   2. Shim Plate Mounting: Provide 1/8-inch-thick concealed aluminum shim plates with predrilled and countersunk holes, where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

D. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings and hardware as appropriate for mounting signs that project from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.

E. Cast Metal Plaques: Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.
   1. Concealed Mounting: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.
   2. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through the face of the plaque into the wall surface.

3.03 CLEANING, PROTECTION AND REPAIR

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 3 feet.

B. After installation, clean sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by Owner.

C. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

3.04 SIGN SCHEDULE

A. Exterior Signs: Refer to drawings, including civil, for sizes, locations, and layout of signage types, sign text copy, and graphics.

B. Interior Signs: Refer to signage phasing schedules and drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

END OF SECTION

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SECTION 10 21 13.16
PLASTIC LAMINATE-CLAD TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic laminate toilet compartments.

B. Plastic laminate doors for changing rooms.

C. Plastic laminate Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 05 12 00 - Structural Steel Framing: Concealed steel support members.

E. Section 05 50 00 - Metal Fabrications: Concealed steel support members.

F. Section 06 10 00 - Rough Carpentry: Blocking and supports.

G. Section 09 30 00 - Tiling: Adjacent Surfaces

H. Section 10 28 13 - Toilet and Bath Accessories.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.07 WARRANTY

A. Provide Manufacturer's standard three-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Laminate Toilet Compartments:
   1. ASI Accurate Partitions; Legacy Plastic Laminate. www.asi-accuratepartitions.com/#sle.

2. Substitutions: Not permitted.

2.02 MATERIALS

A. Particleboard for Core: ANSI A208.1 composed of wood chips, sawdust or flakes, made with waterproof resin binder; 45 lb density, 7/8" thick; sanded faces.
   1. All components shall be edge banded prior to face lamination.

B. Plastic Laminate: NEMA LD 3, HGS. .50 Thickness decorative, vertical grade laminate.
   1. PLAM-19. See Section 06 40 00 - Architectural Woodwork for more information.
   2. Substitutions: Not permitted.

C. Adhesive: non-toxic, water resistant type.

2.03 COMPONENTS

A. Toilet Compartments: Plastic laminate finished, floor-mounted headrail-braced.

B. Doors, Panels, and Pilasters: Plastic laminate adhesive and pressure bonded to faces and edges of particleboard core, with beveled corners and edges; edges of cut-outs sealed.
   1. Plastic Laminate Color: Plastic Laminate Finish: PLAM-19, unless noted otherwise. See section 06 40 00 – Architectural Woodwork for PLAM schedule.

C. Door and Panel Dimensions:
   1. Thickness: 1 inch (25 mm).
   2. See Drawings for size.

D. Urinal Screens: Wall mounted with two panel brackets.

2.04 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inches (75 mm) high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum tube, size by manufacturer, with anti-grip strips and cast socket wall brackets.

C. Wall and Pilaster Brackets: Polished stainless steel.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Steel Plate Reinforcement: Carbon steel, prepared for fasteners, 1/8 inch (3 mm) thick.

F. Hardware: Manufacturer's standard heavy duty hardware. Polished stainless steel.
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Thumb turn door latch with exterior emergency access feature. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door. Omit at Life Time Kids' Academy (LTKA) and replace with wall mounted stop, Jacknob 4123 or eq.
   5. Provide door pull for outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in full closed position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 22 36
COILED WIRE FABRIC AND ATTACHMENT SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coiled Wire Fabric and Attachment Systems.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 05 50 00 - Metal Fabrications.

E. Section 06 10 00 - Rough Carpentry.

F. Section 08 71 00 - Door Hardware.

G. Section 09 21 16 - Gypsum Board Assemblies.

1.03 REFERENCES

A. American Iron and Steel Institute (AISI) - Steel Product Manual; Stainless and Heat Resisting Steel.

B. ASTM A380/A380M - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems; 2017.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

D. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

E. MIL-C-5688 - Pre-Stretching and Proof-Testing of Wire Rope Assemblies.

1.04 DEFINITIONS

A. Coiled Wire Fabric: A building material manufactured by Cascade Coil Drapery. The material is created by interlocking strands of coiled wire to form a larger flexible sheet. Coiled wire fabric is made from a variety of metals and gauges of wire, and in a wide variety of scales.

B. Attachment Systems: Component materials required to present Coiled Wire Fabric in a specified manner (i.e., tensioned flat in two directions, tensioned in two directions with a percentage of fullness, tensioned flat in four directions, hanging in one direction, wrapping a form, etc.), for connecting it to the built environment and for attaining a specified performance capability. Engineered attachments may allow Coiled Wire Fabric panels to remain in a static position or to move, either manually or mechanically.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-Submittal Hardware and Keying Meeting: Prior to preparing final submittals, conduct meeting including Owner, Architect, and supplier of hardware to determine the following:
   1. Lock Function: Demonstrate function/type of each lockset scheduled and verify function at each door.
   2. Electrical Operation: Verify function of openings requiring electrified hardware.
   3. Keying: Determine keying requirements for preparation of final keying schedule.
   4. Submit letter of compliance, indicating when this meeting was held and who was in attendance, to Architect, Owner, and hardware supplier.

1.06 DESIGN / PERFORMANCE REQUIREMENTS

A. Structural Requirements: Provide coiled wire fabric systems capable of withstanding the effects of gravity and applied loads and stresses within limits and under conditions indicated on the Drawings:
   1. Components: Design and size to withstand dead and live loads of components, vegetation, rain, snow and ice and loads caused by positive and negative wind pressure acting normal to plane of the coiled wire fabric as calculated in accordance with applicable code.

B. Coiled Wire Fabric systems shall accommodate expansion and contraction of metal components without causing undue stress, buckling, opening of joints, and distortion.

C. Supports and hardware shall withstand loads encountered without excessive deflection or distortion when cables are tensioned to required amounts required to conform to applicable building codes.

1.07 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittal Procedures.
   1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Shop Drawings: For fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.
      a. Indicate materials, methods, finishes, fittings, hardware, anchorage, and accessory items.
      b. Provide setting diagrams and templates for anchorages and hardware to be installed by others.
      c. Where materials or fabrications are indicated to comply with design loadings, include material and safety factor properties, and other information need for structural analysis.
   3. Structural Calculations: Submit manufacturer’s design data, including structural calculations prepared by a qualified professional engineer.
   4. Samples for Verification:
      a. Submit samples for initial color selection of each specified finish.
      b. Sample size of coiled wire fabric to be 6 in. wide by 10 in. long.
   5. Certificates: 1 mill certificates signed by manufacturers of wire products certifying that products furnished comply with requirements.

1.08 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: Company experienced in manufacturer's products, or similar, for a minimum of 5 years. The Contractor shall provide trained laborers with prior experience in the type of construction involved as well as experience installing the materials and techniques specified.

C. Qualified Professional Engineer: A professional engineer licensed in the state of the Project location and who is qualified to design the portion of the work described in this Section.

D. Pre-installation Meetings: Conduct meetings including Contractor, Architect, fabricator, installer and other subcontractors whose work involves Coiled Wire Fabric to verify project requirements, framing and support conditions, mounting surfaces and manufacturer's installation. Comply with Division 1 requirements.

E. Product Options:
   1. Information on the Drawings and in the specifications, establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, profiles of components, and assemblies as they relate to sightlines, to one another, and 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.
   2. The Drawings indicate size, profiles, and dimensional requirements of Coiled Wire Fabric Systems and are based on the specific system indicated. Refer to Section 01 60 00 - Product Requirements.

F. Modifications: Do not modify intended aesthetic effects as judged solely by the Architect, expect with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

G. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.6/D1.6M.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle and store products according to manufacturer's recommendations. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

C. Exercise care not to scratch, mark, dent, or bend metal components during delivery, storage, and installation.

D. Store Material within limits of for temperature and humidity recommended by manufacturer.

1.10 PROJECT CONDITIONS

A. Verify actual openings by field measurements before fabrication; show recorded measurements on shop drawings.

1.11 COORDINATION AND SCHEDULING

A. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.12 WARRANTY

A. Manufacturer’s standard limited warranty for materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Coiled Wire Fabrics and Coiled Wire Fabric Attachment Systems as indicated on the Drawings. Manufacturer/Contractor shall engineer and fabricate components and assemblies for installation.

B. Manufacturer:
   1. Basis of Design: Cascade Coil Drapery, Inc., PO Box 3707, 19505 SW 90th Ct.; Tualatin, OR 97062; Contact: Andrew Schoenheit Toll Free Tel: 800-999-2645; Tel: 281-771-3339; Fax: 971-224-2199; Email: (request info (andrew@cascadecoil.com); Web: www.cascadecoil.com, www.cascadearchitectural.com, http://www.fabricoil.com

C. Substitutions: In accordance with Division 1 Requirements.

2.02 COILED WIRE FABRIC SYSTEMS

A. Provide Coiled Wire Fabrics and Coiled Wire Fabric Attachment Systems as indicated on the Drawings. Manufacturer/Contractor shall engineer and fabricate components and assemblies for installation.

B. CWF-3: Security Screen
   1. Coiled Wire Fabric.
      a. Material – Aluminum.
      b. Panel Depth – 5/16”.
      c. Wire Gauge – 14GA.
      d. Finish – Metaltone Finish – Powder Coated Antique Bronze.
      e. Fullness – As required.
   2. Attachment Systems - Secura Double Track System for Coiled Wire Fabrics - Direct Mount.
      a. Material – Galvanized Steel.
      b. System Type - (2) #4511S
      c. Finish – Powder coated to Match Fabric.
   3. Guardian Coil Semi Security Gate Systems: Guardian Coil Security Hardware
      a. Double 90-degree (All Track Curves to be 24” Minimum Radius)
      b. Material - Galvanized Steel.
      c. Configuration – The system is to utilize V103, V107 and V111 Channels with S525 Positive Locking Mesh Mount Foot bolt on Secured Side Only.
      d. Fabric Fasteners, hooks and double bolt guardian grade trolley carriers.
      e. Connector Type: #4518-G1B Nylon Carrier w/ hardware staggered @ 7” O.C. Typ.
      f. Receiver Socket for S525 Footbolt to be countersunk into floor and slab and to be flush with finished floor.
      g. Baton - (BT0500XX-S – size dependent on gate height)

1) Material - Stainless Steel.
2) Finish - Powder coated to match fabric.

4. Keying/Locking Device.
   a. Keyed - Unsecured Side, Thumb Turn - Secured Side.
   b. L215 Handle Both Sides.
   c. L200SCH Schlage Lock Assembly.
   d. Schlage Primus Core 20-740-6 pin.
   e. Schlage Mortise Housing PN 20-060626-IC.
   f. Schlage Control Key for Primus core 20-740.
   g. Powder coat finish to match coil system.
   h. Metal Components shall be factory-finished.

2.03 FABRICATION

A. Tolerances: Verify dimensions on site prior to shop fabrication.

B. Fabricate steel and stainless steel in accordance with AISI Steel Product Manual and the manufacturer's requirements.

C. Welded connections shall comply with AWS standards for recommended practice in shop welding. Welds behind finished surfaces shall be without distortion or discoloration of exposed side.

D. Components shall be accurately cut, drilled and/or tapped to receive coiled wire fabric, hardware, fasteners, and accessories.

E. Shop fabricate to designs indicated on Drawings and to meet performance requirements specified. Shop fabricate hardware, interfacing parts and assemblies so that field cutting adjustments are not necessary.

F. Coordinate requirements, dimensions and spacing of attachment systems to ensure required factory drilled holes in supporting framework are correctly located.

G. Make exposed joints butt, flush, and hairline.

H. Fabricate connections that will be exposed to weather in a manner to exclude water, per Architect.

2.04 FINISH

A. After fabrication and/or weaving, clean and prepare Coiled Wire Fabric System in accordance with ASTM A380/A380M, if applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before beginning installation, verify that conditions installed under other sections are acceptable for installation of Coiled Wire Fabric and Attachment Systems in accordance with manufacturer's installation instructions.

B. Coordinate setting diagrams, plans, templates, and drawings and verify the proper installation of any necessary anchorages as detailed in the Drawings.

C. Verify supporting system for Coiled Wire Fabric is prepared for attachment of framework, hardware, anchors and wire rope and transfer of calculated loads.

D. If conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Coordinate with appropriate entity to correct unsatisfactory conditions, if any exist.

F. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.02 PREPARATION

A. Installer to verify inventory components to ensure all required items are available for installation. Inspect components for damage. Remove damaged components from site and replace.

B. Contractor shall verify alignment, support dimensions, and tolerances are correct.

C. Contactor shall verify all necessary framework and blocking is installed prior to mounting Coiled Wire Fabric Attachment Systems to existing structure.

3.03 INSTALLATION

A. Coiled Wire Fabric:
   1. Install Coiled Wire Fabric in accordance with the approved shop drawings.
   2. Assemblies shall be installed based on manufacturer's dimensions and specifications.
   3. Joints shall accommodate expansion and contraction of metal components without causing undue stress, buckling, joint fatigue and/or distortion. Follow manufacturer's installation.
   4. Install manufacturer-supplied brackets and mounting hardware onto Coiled Wire Fabric as indicated in shop drawings for specific Coiled Wire Fabric Attachment Systems. Attach with approved fasteners and techniques to ensure that sections are horizontal and parallel to grade/slab or rake to within 1/16 inch (1.58 mm) in 4 feet (1.2 m).
   5. Verify that support framing and other surfaces to receive Coiled Wire Fabric are clean and free of obstructions.
   6. Follow shop drawings to attach Coiled Wire Fabric to support framing using appropriate manufacturer supplied hardware.
   7. Provide anchorage devices and fittings to secure to in-place construction; including additional frame work, blocking, threaded rods and anchors.
   8. Install infill plumb, level, square, and rigid without kinks or sags.
   9. Anchor Coiled Wire Fabric and Attachment Systems to mounting surfaces as indicated on the Drawings.
   10. Separate dissimilar materials with bushings, grommets, or washers to prevent electrolytic corrosion.
   11. Use manufacturer's supplied hardware.
   12. Tension Coiled Wire Fabric per drawings, or as necessary, so that no slack is visible.
   13. After final adjustment provide tamper resistant lock tight materials on all fittings.

B. Coiled Wire Fabric Attachment Systems:
   1. Install Coiled Wire Fabric Attachment Systems in accordance with the approved shop drawings.
   2. Assemblies shall be installed based on manufacturer's dimensions and specifications.
   3. Joints shall accommodate expansion and contraction of metal components without causing undue stress, buckling, joint fatigue and/or distortion. Follow manufacturer's installation.
   4. Should Coiled Wire Fabric Attachment Systems require wall mounting, the Contractor shall provide structure.
   5. Install manufacturer-supplied brackets and mounting hardware onto Coiled Wire Fabric Attachment Systems as indicated in shop drawings for specific Coiled Wire Fabric Attachment Systems. Attach with approved fasteners and techniques to ensure that sections are horizontal and parallel to grade/slab or rake to within 1/16 inch (1.58 mm) in 4 feet (1.2 m).
   6. Verify that support framing and other surfaces to receive Coiled Wire Fabric and Attachment Systems are clean and free of obstructions.
   7. Follow shop drawings to attach Coiled Wire Fabric Attachment Systems to support framing using appropriate manufacturer supplied hardware.
   8. Provide anchorage devices and fittings to secure to in-place construction; including additional frame work, blocking, threaded rods and anchors.
   9. Install infill plumb, level, square, and rigid without kinks or sags.
   10. Anchor Coiled Wire Fabric and Attachment Systems to mounting surfaces as indicated on the Drawings.
   11. Separate dissimilar materials with bushings, grommets, or washers to prevent electrolytic corrosion.
   12. Use manufacturer's supplied hardware.
   13. Tension Coiled Wire Fabric per drawings, or as necessary, so that no slack is visible.
   14. After final adjustment provide tamper resistant lock tight materials on all fittings.

3.04 ADJUSTING AND CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Clean installed products before owner's acceptance.

B. Follow manufacturer's cleaning instructions. Provide to owner per Closeout Requirements.
   1. Vacuum dust and dirt from fabric with a brush-ended vacuum cleaner.
   2. Use mild detergent and damp rags to remove persistent dust or grease.
   3. Do not use abrasive cleaners.

C. Remove from project site and legally dispose of construction debris associated with this work.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Protect installed products and finished surfaces from damage during construction.

D. Replace defective or damaged components as directed by Architect.

END OF SECTION

SECTION 10 28 13
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Childcare accessories.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 05 40 00 - Cold Formed Metal Framing.

F. Section 06 10 00 - Rough Carpentry.

G. Section 08 81 00 - Glazing.

H. Section 09 21 16 - Gypsum Board Assemblies.

I. Section 09 30 00 - Tiling.

J. Section 10 21 13.16 - Plastic Laminate Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area; 2019.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Construction Manager within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

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.

1.06 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser:
   1. Provided by Owner, installed by Contractor.
      a. See section 01 64 00.

B. Paper Towel (Folded) Dispenser:
   1. Provided by Owner, installed by Contractor.
      a. See section 01 64 00.

C. Paper Towel (Folded) Dispenser:
   1. Provided by Life Time vendor.

D. Foam Soap Dispenser: All locations except shower.
   1. Provided by Life Time vendor.

E. Grab Bar:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties, Inc., 3800 Series.
      b. Bobrick Washroom Equipment Inc., B-6806 Series.
      c. Bradley Corporation, 812 Series.
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
      a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
   4. Outside Diameter: 1-1/2 inches (38 mm).
   5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialities Inc., No. 0852.
      b. Bobrick Washroom Equipment Inc., B-270.
      c. Bradley Corporation, Model 4781-11.
   2. Mounting: Surface mounted.
   3. Door or Cover: Self-closing, disposal-opening cover.
   4. Receptacle: Removable.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Manufactured Mirror Unit: See drawings for size:
   1. American Specialties, 0600 Series.
   2. Or approved equal.

H. Frameless Mirror Glazing: By glazing provider. See 08 81 00.

I. SLIM dri Hand Dryer:
   1. World Dryer Model L-973 with Brushed Stainless Steel Finish.
   2. Or approved equal.

J. Self-Retracting Step: Stainless Steel.
   1. Step ‘n Wash model SNW-SS 975.
      a. Manufactured by Step ‘n’ Wash, Inc., 4829 Mill Brook Drive, Atlanta, Georgia 30338; (770) 677-4000 www.stepnwash.com.
      b. Construction: 14 gauge 304 stainless steel, reinforced with two (2) stainless steel plates Tig welded in place, one (1) stainless steel bracket and one (1) 304 stainless steel support rod.
      c. Mounting: Secured directly to concrete substrate utilizing four (4) stainless steel wedge anchors (supplied by manufacturer) with tension rating of 3999 lbs. and shear rating of 3031 lbs.
   2. Or approved equal.

2.02 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties, Inc., 1204-2 Shower Rod with 1204-1 Flange.
      b. Bobrick Washroom Equipment Inc., B-6047 Series.
      c. Bradley Corporation, Model 9531.
   2. Description: 1-1/4-inch (32-mm) OD; fabricated from nominal 0.05-inch-(1.3-mm) thick stainless steel.
   3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
   4. Finish: No. 4 (satin).

B. Shower Curtain: By Owner.

C. L Shaped Folding Shower Seat:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties Inc., 8206 (L/R).
      b. Bradley Corporation, 9569.
   2. Configuration: L-Shaped.
   3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
   4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
   5. Dimensions: 21” x 32” – see drawings.

D. Towel Hook:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Specialties Inc., 7340-S.
      b. Bobrick Washroom Equipment Inc., B-6717.
      c. Bradley Corporation, 9114.
   2. Description: Single-prong unit.
   3. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Swimsuit Water Extractor:
   1. Products: Subject to compliance with requirements, provide:
      a. The Swimsuit Dryer: Next Generation wall mounted dryer.
      b. Or approved equal.
      c. Color: Cool Gray.
      d. Coordinate with Plumbing and Electrical.

F. Shampoo, Conditioner and Body Wash Brackets, Showers:
   1. Provided by Owner, installed by Contractor.
      a. See section 01 64 00.

G. Weight Scales:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Benchmark SS Steel Bench Scale.
   2. Configuration: Rectangular.
   3. Material: 304 Stainless Steel.
   4. High traction adjustable feet
   5. Dimensions: 18" x 18"

H. Weight Scale Display:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Rice Lake Weighing Systems: 680 Synergy Plus Digital Weight Indicator.
   2. Industrial grade.
   3. Material: 304 stainless steel.
   4. Seven Digit display.
   5. See drawings for mounting heights and details.

2.03 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:
   1. Provided by Owner, installed by Contractor.
      a. See section 01 64 00.

2.04 MOUNTING ACCESSORIES

A. Stainless Steel Screws:
   1. #10 1 3/4" length 18-8 Stainless Steel Screw.

B. Nylon Spacer:
   1. 7/16" length plain round nylon spacer for #10 screw.

2.05 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 6 keys to Owner's representative.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories per manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Install all accessories on surfaces which are waterproofed (tile walls in wet areas, see drawings) according to the waterproofing manufacturer's instructions. See Section 09 30 00 - Tiling.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

END OF SECTION

SECTION 10 28 19
GLASS SHOWER DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Tempered Glass Shower Doors.
   2. Hardware.
   3. U-Channel.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 08 81 00 - Glazing.

F. Section 09 30 00 - Tiling.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For shower compartments. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For the following products, unless otherwise indicated:
   1. Glass sample, prepared on 6-inch- (152-mm-) square of same thickness and material indicated for Work.
   2. Each type of hardware and accessory.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for glass shower doors designated as accessible.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of shower partitions, and other construction contiguous with glass shower doors by field measurements before fabrication.

PART 2 PRODUCTS

2.01 GLAZING

A. See Glass type G8, Section 08 81 00.

2.02 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Stainless steel.
   2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
      a. Manufacturer: C. R. Laurence Co., Vienna, Wall Mount Hinge, Cat. No. V1E037 (3 hinges per door). Finish: Satin Nickel.
   3. Door Pull: C. R. Laurence Co., Door Pull, Cat. No. BM8X8. Finish: Satin Nickel.
   4. Misc Brackets, fasteners:
      a. C.R. Laurence Co., Vienna Series. Finish to match Hinge. See drawings for number and location.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

3.02 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Fire protection cabinets for fire extinguishers.
   2. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 09 21 16 - Gypsum Board Assemblies.

F. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

G. Section 09 30 00 - Tiling.

H. Section 09 75 00 - Interior Stone.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

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. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

E. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 PRODUCTS

2.01 FIRE PROTECTION CABINET

A. Standard Cabinet: Suitable for fire extinguishers, general areas.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. JL Industries, Inc., a division of Activar Construction Products Group: Academy Series with V Door and Safe-T-Lok opt.
      b. Larsen's Manufacturing Company: Architectural Series-AL with vertical duo door style and Larsen-Lok opt.
      c. Modern Metal Products, Division of Technico Inc: FSB Series.
      d. Approved substitution.
   2. Cabinet Material: Aluminum sheet.
   3. Cabinet Mounting:

a. (FEC-1) Semi-recessed Cabinet: As indicated on drawings. Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
   1) Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
b. (FEC-2) Surface mounted: As indicated on drawings.
c. (FEC-3) Fully Recessed: As indicated on drawings. Metal trim as provided by manufacturer.

4. Cabinet Trim Material: Aluminum sheet.
5. Door Material: Aluminum sheet.
6. Door Style: Vertical duo panel with frame.
7. Door Glazing: Clear tempered glass.
8. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
9. Finishes: Aluminum Clear Anodic.

B. (FEC-4) Moisture and Chemical Resistant Fire Extinguisher Cabinet: Suitable for fire extinguishers, to be used in pool areas.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cato, Inc. Chief CHPCP-5.
   b. JL Industries, Inc., a division of Activar Construction Products Group: ABS Plastic Indoor/Outdoor Cabinet.
   c. Or approved equal.
2. Cabinet Material ABS Plastic.
3. Cabinet Mounting: Surface Mounted.
4. Door: Clear acrylic.
5. Door Hardware: Manufacturer's standard corrosion resistant hardware of proper type for cabinet and door.
6. Color: White.

C. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
   a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER".
      1) Location: Applied to location indicated on Drawings.
      2) Application Process: Decals.
      3) Lettering Color: Red.
      4) Orientation: Horizontal or as indicated on Drawings.

2.02 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. Miter and weld joints and grind smooth.

2.03 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. General use ABC Fire Extinguishers: Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5 pound (2.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container. Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. JL. Industries, Inc.; a division of Activar Construction Products Group: Cosmic 5e
   b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.: Pro 5MP
   c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.: Excel XL10TC2.
   d. Larsen's Manufacturing Company: MP5
   e. Approved substitution.
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard stainless steel.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Type "K" fire extinguishers for food service areas:
1. Manufacturers: UL rated for Class A and K fires. Subject to compliance with requirements, provide products by one of the following:
   a. JL. Industries, Inc. a division of Activar Construction Products Group; Saturn 15
   b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.: Six Liter Class K 25074
   c. Larsen's Manufacturing Company: WC 2 1/2
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard stainless steel.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.04 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amerex Corporation. Trussville Alabama.
   b. Ansul Incorporated; Tyco International Ltd. Sentry Brand.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company. North Carolina.
   e. L. Industries, Inc.; a division of Activar Construction Products Group.
   f. Larsen's Manufacturing Company.
   g. Potter Roemer LLC. Chicago area.
   h. Approved substitution.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
   a. Orientation: Horizontal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply decals at locations indicated.

E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

G. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

H. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 40 inches above finished floor to top of fire extinguisher.

I. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 11 00 10
DIVISION 11 TABLE OF CONTENTS

DIVISION 11 – EQUIPMENT

11 08 00 - Commissioning of Equipment
11 21 73 - Commercial Laundry Equipment
11 40 00 - Food Service Equipment
11 40 01 - Food Service Equipment Schedule
11 66 00 - Athletic Equipment

END OF SECTION

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SECTION 11 08 00
COMMISSIONING OF EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

E. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Commercial Laundry Equipment
   2. Athletic Equipment

END OF SECTION

SECTION 11 21 73
COMMERCIAL LAUNDRY EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Commercial washers.
   2. Commercial dryers.
   3. Steel base.
   4. Lint filters.
   5. Drain Trough.
   6. Edge Gasket.

B. Contractor-Furnished Equipment: Washers, dryers and lint filters to be delivered to Project. Installer to provide proper connections and venting.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operations and Maintenance.

E. Section 11 08 00 - Commissioning of Equipment.

F. Section 22 40 00 - Plumbing Fixtures.

G. Section 26 27 17 - Equipment Wiring.

1.03 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.04 SUBMITTALS

A. Product Data including manufacturer’s specification for installation. Provide data substantiating that products comply with requirements.

B. Shop Drawings: show equipment layout, drainage trough, base, curb details, and coordination with plumbing.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide and install the following:
   1. Electrolux:
      a. Or approved equal.
      b. Contact: David Selib; Laundrylux. 516-371-4400 dselib@laundrylux.com

2.02 EQUIPMENT

A. Dryers:
   1. Style: Commercial Tumble Dryer.
      a. Acceptable Product: Electrolux DE683

B. Washers:
   1. Style: Washer Extractor.

a. Acceptable Product: Electrolux EUD-660 CV
b. One washer base per machine.
1) Steel base by Manufacturer.
2) Coordinate height with drain trough and curb.

C. Steel equipment base:
1. By Manufacturer, coordinate height with Drain Trough and curb.

D. Lint Filters:
1. Acceptable Product: Small Wonder OPL-202 with wall mount by Clean Cycle Systems.
a. Or approved equal.

E. Drain Trough:
1. Acceptable Product: Polypropylene Trough.
a. Height: Coordinate with washers, base, curb, plumbing and installation details to ensure proper drainage.
b. Sizing: See drawings for proposed sizing.
c. Drainage:
1) Trough to be configured for top gravity drain.
2) Coordinate location of drain apperatures with equipment layout.

2.03 ACCESSORIES

A. Edge gasket: Natural Elastic Abrasion Resistant Rubber. (gum rubber)
1. Temperature range: -45 to 200 deg F.
2. Tensile Strength >/= 2500 psi.
3. Thickness: 1/16" Min.
4. Width: See detail.
5. Color: White, Gray or Tan.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify location and sizes of curbs, plumbing and electrical connections.

B. Ensure waterproofing has been installed and is in acceptable condition prior to installation.

3.02 COORDINATION

A. Coordinate locations of washer drains with curb, base, drain trough and floor drains to ensure proper functioning of equipment.

B. Ensure that electrical connections are well clear of plumbing connections and wet areas.

3.03 INSTALLATION

A. Install equipment according to Manufacturer's Instructions, details and approved shop drawings.

3.04 PROTECTION

A. Protect installed equipment from other construction activities.

3.05 TESTING

A. Test all equipment for proper functioning and according to Commissioning requirements, see 11 08 00.

3.06 OPERATIONS AND MAINTENANCE

A. Provide training and O&M materials as specified in Section 01 92 00.

END OF SECTION

SECTION 11 40 00
FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes some or all:
   1. Fabricated equipment.
   2. Food waste machines.
   3. Cooking equipment.
   4. Refrigeration equipment.
   5. Walk-in refrigeration equipment.
   6. Powered food-preparation equipment.
   7. Warewashing equipment.
   8. Serving equipment.

B. Owner-Furnished Equipment:
   1. Where indicated, Owner will furnish and install owner supplied equipment.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Division 21, 22, and 23 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete foodservice equipment installation.

F. Division 26 Sections for connections to fire-alarm systems, wiring, disconnect switches, and other electrical materials required to complete foodservice equipment installation.

1.03 REFERENCE STANDARDS

A. 21 CFR 177 - Indirect Food Additives: Polymers; Current ed..

B. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

E. NFPA 54 - National Fuel Gas Code; 2024.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

1.04 PROJECT DESCRIPTION

A. Scope of Work: work called out in FSEC plans and contract will be performed within the contract price. It is clearly understood and agreed that the FSEC shall provide all material, labor, trucking, hoisting, shop drawings, layout, equipment, supervision, insurance, applicable taxes, bonds, etc., necessary for the furnishing and installation of all specified work contained herein in accordance with the contract drawings, specifications, addenda and riders, all of which become part of this Contract. The scope of work shall include, but be limited to, all the Food Service Equipment work shown on the drawings and described in the following Specifications Section, except such work as may be specifically excluded.

B. Intent of Documents: The intent of the contract documents is to describe complete systems and items. Provide appurtenances and accessories specified in the specifications or indicated on the drawings required for a complete installation and safe functioning of equipment or systems.

C. The contract documents are complimentary, and what is required by one shall be as binding as if required by all. In the event that there are discrepancies in or between the documents, neither shall be interpreted as taking precedence over the other. Notify the Architect or Kitchen Designer of all discrepancies in writing. The Kitchen Designer or Architect will issue a written clarification.

D. Terms and Abbreviations: The following abbreviations are used on the drawings.
   1. EC: Electrical Contractor
   2. GC: General Contractor or other Prime Contractors
   3. HVAC: Heating, Ventilation, Air Conditioning Contractor
   4. ID: Interior Designer
   5. KEC: Kitchen Equipment Contractor
   6. MWC: Millwork Contractor
   7. ONR: Owner
   8. OPR: Operations and Engineering
   9. PC: Plumbing Contractor
   10. VDR: Vendor

E. Work by Owner and Under Other Contracts: During the course of the work, separate contracts may be let for other work. Coordinate work under the contract required for smooth completion of the work.

F. General construction coordination requirements under separate contract and not included in Kitchen Equipment Contractor (KEC) scope of work:
   1. Coordination of furnishing of specialized fittings to installing trade for installation into work.
   2. Furnishings including, tables, chairs, cash registers, point of sale systems, cashier stools, furniture are provided under separate contracts. Coordinate installation with kitchen equipment.
   3. Miscellaneous equipment and systems including rolling stock, dispensing systems for juice, and soda, beverage conduit, cooking utensils, dishes, flatware, soap and chemical injection systems, except as specified.
   4. Beverage line conduit or cable trays, including boring necessary holes.
   5. Grout backfill around floor pans and sealing around floor pans and equipment.

G. HVAC coordination requirements under separate contract and not included in KEC scope of work:
   1. Final duct connection, connecting duct work, controls and blowers to ventilation hoods.
   2. Receiving, Hanging & leveling of all hoods, wall panels and controls.
   3. Air balance testing.
   4. HVAC services required for operation of equipment.

H. Plumbing coordination requirements under separate contract and not included in KEC scope of work:
   1. Final connections and interconnections including traps, floor troughs, trench drains, drain lines, connection pipe, shut off valves, connection to equipment items.
   2. Verify incoming hot water.
   3. Interconnecting piping from booster to dishwasher.
   4. Plumbing services required for operation of equipment. Including water Temperature, Pressure and hardness

I. Electrical coordination requirements under separate contract and not included in KEC scope of work:
   1. Final connections and interconnections of equipment including external wiring, connecting conduit, and external connections to equipment.
   2. Required electrical equipment shut off devices.
   3. Installation of electrical control switches and starters not part of or attached to equipment.
   4. Electrical services required for operation of equipment.

J. Use of Site: Limit use of site to extent required to perform work and to limits indicated on drawings.
   1. Keep entrances clear and available.
   2. Do no block entrances, fire exits or lanes, or delivery routes.
   3. Do no use unauthorized areas for parking or storage of materials.
   4. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

5. Immediately remove any crating or other debris resulting from installation of Food Service Equipment and dispose of in general contractor supplied dumpster

K. Noise Control: Minimize objectionable noise levels and notify Owner in advance of noisy operations.
1. The Owner reserves the right when necessary to require excessive noise transmitting procedures be stopped during certain periods of time.

L. Owner Occupancy
1. Full Owner Occupancy: The Owner will occupy site and existing building during entire construction period. Occupancy and placing of equipment during the work does not constitute acceptance of the work.

1.05 GENERAL CONDITIONS

A. The KEC represents that it is familiar with, and has expertise in the work of this Scope. The KEC further agrees that it will provide all work for the Scope as may be required to make a complete job of that which may not be fully defined in the Contract Documents.

B. The KEC has examined the site and the contract documents and reviewed with the Construction Manager the designated areas of access, delivery, and storage for the Contractor's use. The KEC agrees that such areas are satisfactory and sufficient for its needs in the prosecution of its work in the conformance with the terms of the contract. Any changes in such areas shall not be permitted without the approval of the FSEC, Construction Manager and Owner, which if approved, shall be at no additional cost.

C. All hoisting and hoisting requirements less than 35' for the KEC's materials and equipment are the KEC's responsibility. The KEC shall place its hoisting equipment in locations approved by the Construction Manager. Any separate hoist engines shall be relocated as required as the project progresses if required by the Construction Manager so as to avoid interference with work of other contractors.

D. Any temporary openings or leaveouts required for subsequent installation of KEC's work must be brought to the attention of the Construction Manager prior to the start of the pertinent work in the areas of the opening or leaveout needed. Failure to request access will result in the KEC assuming all costs involved in providing, rebuilding, and refinishing the required access.

E. The KEC will provide protection necessary to safeguard its own work, as well as the work of other trades, from damage by its own operations.

F. The KEC will visit and carefully examine the premises upon which the building is being erected and familiarize itself with the existing conditions and difficulties that may affect the execution of its work. The KEC is aware that its work is being performed adjacent to other ongoing work. The KEC agrees that it will take all necessary steps to avoid damage to new and existing construction. Any damage caused by the KEC will be repaired by the KEC at no additional cost.

G. All permits required for the KEC's work shall be procured and paid for the by KEC.

H. This KEC shall cooperate, as directed by the Construction Manager, with other contractors that shall be commencing operations on the site prior to this KEC's completion and demobilization.

I. The Construction Manager must approve all on-site material storage locations.

J. Should the KEC propose any design changes that might save in costs, he will submit his proposal, drawings, calculations, etc., for approval by the Kitchen Consultant. The KEC will assume all costs for reimbursing the Owner for all fees incurred by the Engineer of Record as a result of said changes.

1.06 PROJECT COORDINATION AND MEETINGS

A. Coordination of Work by the Kitchen Equipment Contractor: Coordinate scheduling of kitchen equipment, submittals, and specified kitchen equipment work to ensure efficient and orderly sequence of installation of interdependence.
1. Review kitchen designer's drawings for completeness and accuracy with equipment being furnished. Notify Owner or his agent in writing of changes required with copy to the kitchen designer.

2. Examine utility rough-ins in field prior to closing of walls and ceilings. Notify the Owner or his agent in writing of discrepancies.
3. Protect wall ends and columns during the installation of kitchen equipment work.

B. Prior to commencement of work, KEC to verify with GC that the installation conditions are acceptable and ready to receive kitchen equipment, including but not limited to:
1. Field measurement and verification of finished dimensions for placement of equipment and manufactured items. Coordinate requirements with affected trades for alternations necessary to accommodate equipment and manufactured items.
2. Verify physical space conditions are acceptable for installation of specified equipment.
3. Note obstructions; scribe and fit equipment to and around obstructions ensuring a sanitary, homogeneous installation.
4. Verify floor pans and walk-in depressions are correctly located and sized.
5. Verification that mechanical and electrical work complies with the drawings as closely as possible, including routing shown for pipes, ducts, and conduit.
6. Verification that openings receiving equipment including drilling of holes, installation of mechanical, plumbing, electrical, and refrigeration connections are ready to receive kitchen equipment work.
7. Verification that required concrete and masonry work required are ready for installation of kitchen equipment.
8. Verification of installation of beverage conduit and cable trays and coordination with owners beverage installer for a complete and sanitary install.

C. Meetings: Kitchen Equipment Contractor shall participate, virtual or in person, in meetings as required for coordination of kitchen equipment specified under this contract.

1.07 PROJECT PROCEDURES

A. Cutting and Patching: When the installation of kitchen equipment requires minor cutting and patching of existing work.
1. Submit written request in advance of cutting or altering structural or building enclosure elements.
2. Fit work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
3. Refinish surfaces to match adjacent finishes.
4. Restore to original or required fire and smoke ratings.

B. Protection of Work: Protect existing and new work and equipment from damage until the work is complete and materials and apparatus have been tested and accepted. Repair or replace at no expense to Owner, Architect, or Consultants.

C. Existing Conditions: Exercise care to prevent damage to existing work, equipment, fixtures, utilities, and similar items during construction period until final acceptance.

D. New Construction and Equipment: Protect work, equipment and materials in accordance with recommendations of manufacturer. Cover work, equipment, and materials to protect from dirt, construction dust, traffic, wear, and injury including damage from workmen; promptly repair damage to work of other trades, existing conduits, ducts, drains, sewers, pipes, utilities, and similar items resulting from installation procedures and methods at no expense to the Owner.

1.08 DEVIATION FROM THE CONTRACT DOCUMENTS

A. Design Criteria: Dimensions specified by kitchen designer for equipment, systems, and manufactured items, including mechanical and electrical connections are intended to establish general profiles and physical characteristics. Final drawings, dimensions and utility information are the responsibility of the KEC. Verify in accordance with specifications.

1.09 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical specifications for each type of equipment.. Also include the following:
1. Manufacturer's model number.
2. Accessories and components that will be included for Project.

3. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
   1. KEC to submit digital , at minimum ¼” scale with horizontal and vertical control for:
      a. All utility services and points of connection to equipment.
      b. Slab depressions.
      c. Wall and partition locations.
      d. Ventilation duct locations and air volumes.
   2. Submit within 4 weeks digital shop drawings at minimum 1/2” scale for fabricated equipment showing construction details, reinforcement, installation and relationship to adjoining and related work, attachment and anchorage if necessary
   3. Submit within 4 weeks after award of contract a digital copy of specifications with specified model number, options, accessories, modifications and Utility requirements.
   4. The above documents are not to be issued to the field until all drawings and manufacturer’s data have been stamped approved by Architect and Kitchen Designer.
   5. Purchasing and fabrication of equipment is not to be started until related submittals have been approved.
   6. Upon receipt of approval of submittals provided to Architect for distribution.

C. Samples: Submit the following items as necessary:
   1. Items requested by Owner and Architect, of adequate size and quantity for testing and review.
   2. Include any costs of samples in contract sum.

D. Wiring Diagrams: Submit schedule showing proposed electrical characteristics of each piece of equipment and disconnect means provided.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For foodservice equipment to include in operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. If requested, Provide maintenance data for each item of food service equipment for all equipment with a plumbing or electrical connection . At project closeout submit digital copies.
   2. Submit as built shop drawings of each piece of custom equipment.
   3. Provide name, telephone number of service company or manufacturers service contact for each piece of equipment for equipment requiring plumbing or electrical connnection, so service or spare parts can be readily obtained.
   4. Kitchen Designer will maintain one identical file copy.

B. Test each heated, cooled, or mechanical operated fixture in accordance with industry standards and manufacturer’s recommendations.

C. Project Record Documents: Submit As Built diagram of refrigeration piping system, including location, manufacturer and model number for gauges, traps, valves and similar items.

1.11 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Regulatory Requirements:
   1. NSF Standards: Comply with applicable National Sanitation Foundations standards, or approved alternate, and recommended criteria. Provide each principal item of food service equipment with NSF *Seal of Approval*.

2. UL Labels: Provide UL Labels on prime electrical components of food service equipment, as applicable. Provide UL recognized marking on items with electrical components, signifying listing by UL, as applicable.
3. ANSI Standards: Comply with applicable ANSI standards for electric powered and gas burning appliances, for piping to compressed gas cylinders, and for plumbing fittings including vacuum breakers and air gaps to prevent siphonage in water piping.
4. NFPA Codes: Install food service equipment in accordance with National Fire Protection Codes (NFPA):
   a. NFPA 54 National Fuel Gas Code.
   b. NFPA 70 National Electrical Code.
   c. NFPA 96 Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment.
5. ASME Boiler Code: Construct steam generating and closed steam heating equipment to comply with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code; Section IV for units not exceeding 15 psi or 250 degrees F (121 degrees C), or Section I for higher pressure/temperature units.
6. Health Code Requirements: Comply with all requirements of the Health Department that has jurisdiction at the project.

C. Certification Labels: Provide equipment complying with standards and bearing appropriate certification labels:
   1. AGA certification for all Gas connected equipment.
   2. UL Standards: Electrical components with UL labels.
   3. NSF Standards: Equipment and fabricated items with NSF labels.

D. All equipment shall be provided and installed in accordance with laws, ordinances, rules, codes and regulations of all authorities having jurisdiction.

E. Manufacturers' Qualifications: Firm regularly engaged in manufacturer of food service equipment and having minimum 5 years documented experience with types, capacities, and sizes required.

F. Installer's Qualifications: Experienced Installer having minimum 5 years documented experience with installation of food service similar in material, design, and extent.

G. Preinstallation Conference: Conduct conference with Project site staff.

1.12 QUALITY CONTROL

A. Control of Installation: Monitor quality control over manufacturers, fabricators, site conditions, and workmanship to protect work of specified quality
   1. Comply with manufacturer's instructions.
   2. Comply with specified standards for minimum quality requirements except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

B. References: Comply with references standards by date of issue current as of date of contract documents. In the event of conflict, request clarification prior to commencement of work.

1.13 MATERIALS AND EQUIPMENT

A. Products: Provide new materials, components, equipment, fixtures, and systems to form work. Use interchangeable components of the same manufacturer for similar components.

B. Transportation, Handling, Storage, and Protection: Transport, handle, store, and protect materials in accordance with manufacturer's instructions.

C. Product Options:
   1. Referenced Standards: Any product or materials meeting standards or description.
   2. Performance Characteristics: Products or materials stating minimum primary performance requirements, characteristics, or features necessary for the proper function and application of the item.

3. Proprietary items: Products or materials of named manufacturer and meeting specifications; no options or substitutions allowed.
4. Semi-proprietary Items: Products or materials of named manufacturers and meeting specifications; contractor's option of manufacturer.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's protective containers.
   1. Inspect containers and equipment promptly upon receipt for damage. Do not accept delivery of damaged items.

B. Verify all specified equipment is delivered and labeled for intended location using equipment numbering system indicated on drawings and in the specifications.

C. Store kitchen equipment in original containers under cover and provide protection to equipment.

D. Handle kitchen equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged equipment; replace and return damaged components to equipment manufacturer.

1.15 PROJECT CONDITIONS

A. Obtain final Architectural, Mechanical, Plumbing, Electrical, Structural and Interior Design Drawings prior to preparing submittals or beginning work.

B. Provide materials, equipment, components, and accessories new and of kinds specified and in undamaged condition when turned over to Owner. Provide workmanship of best quality by skilled craftsmen.
   1. Provide appliances of rigid construction, free from objectionable vibrations, and quiet in operation.

C. Take field measurements to assure accurate fit of Fabricated equipment.

D. Before beginning work review documents for conflicts with Food Service Equipment. Notify the Architect of any conflicts.

1.16 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:
   1. Overhead equipment supports.
   2. Equipment bases.
   3. Floor depressions.
   4. Insulated floors.
   5. Floor areas with positive slopes to drains.
   6. Floor sinks and drains serving foodservice equipment.
   7. Roof curbs, equipment supports, and penetrations.

1.17 WARRANTY

A. KEC shall be fully responsible for all warranties and/or guarantees required by the Specifications, or where applicable, shall share reasonability with the particular manufacturer co-signing the warranty. Any cost related to such warranties shall be included in the contract price. No portion of the work under this Contract shall be considered substantially complete until the applicable warranty and/or guarantee is delivered, in acceptable form, for that work, and all references to substantial completion for purposes of payment or warranty shall be likewise contingent on such delivery.

B. Any repairs, replacements, etc., to be made under the provisions of the aforementioned warranties and/or guarantee shall be made by the KEC at no additional cost to the Construction Manager within three (5) days' notice by the Construction Manager to remedy the defect.

C. Subsequent to the warranty/guarantee periods specified, it any of the defects previously warranted appear, the KEC shall be available for the consultation at any time without cost. He further agrees to

remedy any such defect (if so required by the Construction Manager or Owner) at his actual certified cost of such repairs plus 15% overhead and profit.

D. The equipment furnished under this contract shall carry a parts replacement warranty for a period of (1) year from date of start-up of the equipment against defective materials and/or workmanship involved in the manufacture of the equipment and/or as offered by the respective equipment manufacturers. If any part or parts fail during warranty period, the KEC shall ship the parts at no charge to the Owner, providing the defective part is returned for inspection within (30) days from receipt of the replacement part.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers: Provide specified equipment and components by one of the following:
   1. Cutting Board: Mapletex, Richlite, White Poly.
   2. Door and Drawer Pulls: Component Hardware.
   3. Door Hinges: Component Hardware.
   4. Faucets: Fisher Manufacturing, T&S Brass.
   5. Gas Hoses: Dormont or T&S Brass.
   6. Paint: Krylon, Rust-O-Leum.
   7. Refrigeration System: See Equipment Schedule.
   8. Refrigeration Tubing Insulation: Armstrong, Armaflex.

B. Stainless Steel: Austenitic 18-8 Type 304, with a content of 18 percent to 20 percent chrome, 8 percent to 10.5 percent nickel and a maximum carbon content of 0.08, free from scale. Polish surfaces to #4 commercial finish, except where noted.
   1. White Metal and Iron Pipe: The use of white metal and iron pipe in lieu of stainless steel is prohibited.

C. Galvanized Steel: Galvanize on eight percent (8%) copper bearing alloy sheet, with hot pure zinc galvanizing complying with ASTM A 525, G90 zinc coating, chemical treatment.
   1. Welded Galvanized Steel: Clean seams and remove scale; finished with prime coat of aluminum paint.

D. Stainless Steel Pipe and Tubing: Seamless or welded, gauge specified in schedule, of true roundness complying with ASTM A554, Type 304 with No. 4 polished finish.
   1. Verify tubing is annealed, pickled, ground smooth, and finished to match adjacent work.
   2. Welded Tubing: Heat treated and quenched to eliminate carbide precipitation’s; drawn true to size and roundness and ground as required.
   3. Exposed Tubing: Provide final grind of minimum of 180 grit emery.

E. Miscellaneous Structural Steel Shapes: For angles, band, channels or other structural shapes used for framing, provide uniform and ductile units, free of hard spots, runs, checks, or surface defects.
   1. For galvanized or tinned shapes, provide hot dipped galvanized or tinned with fluxes removed. Remove excess spelter from galvanized shapes. Verify shapes are smooth and free from cold runs, blisters, uncoated or scaly patches.

F. Handles, Brackets, Locking Devices, and Hardware: Provide heavy satin finish chrome plated brass, stainless steel, or metallurgical composition of specified item.

G. Locks where specified: Provide extra heavy duty chrome plated cylinder lock for sliding and hinged doors, drawers, enclosed cabinets, refrigerators, storage bins. Master key kitchen locks for doors, drawers, storage bind, and similar equipment.
   1. For multiple kitchens, provide each with separate master keying systems.

H. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide sealant meeting requirements of Food and Drug Administration Regulation 21 CFR 177.2600 when cured and washed in areas where in contact with food.
   1. Color: Selected by Architect from standard colors.
   2. Backer Rod: Closed cell polyethylene rod stock, larger than joint width.

I. Gaskets: Solid or hollow neoprene or PVC; light gray, minimum 40 Shore A hardness, self adhesive or prepared for either adhesive application or mechanical anchorage. Cellular materials are not permitted.

2.02 ELECTRICAL CHARACTERISTICS AND MOTORS

A. Electrical Requirement: Provide electrically operated equipment listed by the Underwriter's Laboratories, Inc.

B. Plugs:
   1. Equip single phase electrical plug-in equipment with 3 wire cords. Supply 3 wire cap with equipment.
   2. Equip 3 phase electrical plug in equipment with 4 wire cord. Supply 4 wire cap with equipment.

C. Ground Fault Receptacles: Locate receptacles to conform with National Electrical Code and local jurisdiction. For equipment requiring disconnects. Provide in accordance with the National Electrical Code. Refer to electrical drawings for disconnects. Coordinate providing disconnects with electrical work.

2.03 COLD STORAGE ROOMS

A. Panel Fabrication
   1. Panels shall be pre-fabricated, sectionally constructed and designed for accurate assembly.
   2. Panels shall be four inches and shall be completely filled with rigid 100% foamed-in-place Class I urethane between interior and exterior metal "skins" which have been die-formed and gauged for uniformity in size. Slab urethane, high-density rails or wood shall not be acceptable in any panel including doors, walls, floor, and ceiling.
   3. The insulation shall have a 97% closed cell structure with an average in-place density of 2.2 lbs. per cubic foot, and a compression strength at yield point of 19 lbs. per square inch.
   4. Panels shall be of tongue and groove design with foamed-in-place gaskets for a tight fit and maximum insulation.
   5. Corner panels shall be 90 degree angles with coved interiors and actual 12" exterior horizontal measurements.

B. Floors: Unless otherwise specified.
   1. Verify that building is transit level prior to installing walk-ins. Floorless on slab: insulation, vapor barrier and thermal break, and final floor finish by General Contractor.

C. Finish:
   1. Interior wallsand exposed exterior Per spec. exterior stainless to be 22 gauge stainless steel. If required, Box to have 1/8" aluminum treadplate attached to panel skin and siliconed sealed at all edges as per drawings. Follow written specifications

D. Accessories:
   1. 3" X 3" Stainless steel angle trim-10' long.
   2. LED light fixtures,
   3. Stainless steel closure panels.

E. Assembly of Panels:
   1. This shall be accomplished by Posi-locs which shall be foamed-in-place and activated by a hex wrench. Access ports to the locking devices shall be covered by snap caps and shall be located on the interior of the walk-in.
   2. N.S.F. listed gasket shall be foamed-in-place (not glued, stapled or nailed) to the male side of all panels, on both the interior and exterior. Gaskets shall be impervious to stains, greases, oils, and mildew.

F. Warranties:
   1. Panels to be covered by a ten (10) year warranty.

G. Approvals:
   1. Each panel shall have a thermal conductivity (k factor) of .121 (.121)/hr./sq. ft. per degree Fahrenheit per inch; and an overall coefficient of heat transfer (u factor) of not more than .030.

2. Fire hazard classification according to ASTM E84 (UL 723) shall be a flame spread rating of 25 or less with a certifying Underwriter Laboratory label attached to every panel showing the meeting of the fire code. Urethane panels shall be CFC free.
3. Smoke development rating to be 450 or less; with Factory Mutual approval; N.S.F. listed; and Toxicity rated and approved by U.S. Testing.

2.04 REFRIGERATION AND REFRIGERATION EQUIPMENT

A. When rack system is specified: Outdoor Refrigeration Rack System per specification as follows:
1. System shall be constructed of 14 gauge galvanized steel with lockable bi-parting doors. Entire frame shall be pre-assembled, welded, cleaned, and painted with a prime coat of DP epoxy-based paint and finished with one coat of Baja Beige polyurethane acrylic enamel.
2. MULTI-CIRCUITED CONDENSER will be sized to operate at an average differential of 20ºF over ambient temperature. Hot air discharge from condenser fans shall be vertical. Fan motors shall not be less than 3/4 H.P. and protected with a rain shield. A venturi contoured air scoop shall be provided for each fan to reduce air turbulence and fan loading. To reduce power consumption, fans shall be equipped with thermal sensing controls mounted inside the control panel designed to operate the minimum number of fans required for adequate air flow under varying ambient conditions. Fan blades shall not be less than 24" diameter and protected with a plastic coated fan guard.
3. Each condensing unit system shall be equipped with an ACCESSIBLE HERMETIC, scroll or DISCUS. Each system shall include dual pressure controls with stainless steel braided hoses (Super-hose), filter drier, sight glass, discharge and suction-line vibration eliminators, flooded head pressure controls and crankcase heater for low ambient control all of which shall be factory assembled and installed.
4. Each condensing unit system shall be equipped with a properly sized receiver tank with pump-down capacity large enough to accept the total liquid volume of refrigerant without exceeding 80 percent of its volumetric capacity. Each receiver shall be equipped with inlet and outlet isolation valves with service ports.
5. Refrigerant shall be current DOE requirement used for medium temperature systems and for low temperature systems.
6. ELECTRICAL CONTROL PANEL: The refrigeration system shall have an external factory-mounted and pre-wired (NEMA 3 EQV.) electrical control panel complete with an industrial grade interlocked main-fused disconnect with separate compressor and fan motor circuit breakers, contactors and defrost time clocks for single point power connection. Each internal wire shall be color-coded and numbered. The numbers of each individual wire shall be noted on the wiring diagram. A wiring schematic photo-etched onto a .012 aluminum plate shall be permanently affixed inside of the control panel.
7. PRE-PIPING: All refrigerant lines shall be type "L" tubing and extended to one side of the package in a neat and orderly manner with ends of lines capped and identified by system using photo-etched tags. All tubing shall be securely supported and anchored with uni-struct channel and clamps with Neoprene Grommets. Suctions lines shall be wrapped and insulated to prevent condensate accumulation. All piping shall be pressure-tested at the factory with nitrogen at 150 psi (1034.21 kPa) for low side and 400 psi (2757.90 kPa) for high side. All systems shall be shipped from the factory with a 25 psi (172.37 kPa) holding charge.
8. EVAPORATOR COILS: The evaporator coils as specified by the R-1 drawing shall include a compressor BTU matched low-profile end mount evaporator coil. Each evaporator coil shall include liquid-line sub-cooling circuit, thermostat, balanced port expansion valve and liquid- line solenoid valve all mounted and wired, as required, at the factory.
9. RATING PLATE IDENTIFICATION, WIRING SCHEMATIC AND NAMEPLATE: Rating plate identification made of aluminum plate shall be permanently affixed to the outside of the system and include the following information as per U.L. standard 303:
    a. System Model and Serial Number.
    b. Electrical power supply, minimum circuit ampacity and Maximum Fuse Size.
    c. Electrical data for Condensing Units, Evaporator Coils and Condenser Fan Motors.
    d. Individual System Identification and Horsepower.

e. Type of Refrigerant.
f. Control Number.
g. Wiring Schematic. A wiring schematic photo-etched onto .012 aluminum plates shall be permanently affixed inside the control panel.
h. Nameplates. Separate nameplates photo-etched onto .012 aluminum plates shall be affixed to idenify condenser and fan motor circuit breakers, remote fan motor capacitors, thermal sensing fan cycle controls, and time clocks. These nameplate shall be located above or below each item inside the control panel.

10. INSTALLATION:
    a. Refrigeration Contractor: The installing Refrigeration Contractor shall obtain all permits, mount evaporator coils, provide and install refrigerant piping, fittings, hangers, support, hook-up and start-up as per manufacturers Preparation and Start-Up Procedure. The Preparation Start-Up Procedure should be filled out, signed and returned to Manufacturer within ten (10) days of start-up. All copper tubing shall be refrigerant grade type "L". Sil- fos 15 shall be used, not soft solder. After the system and unit cooler have been connected, the balance of the system shall be leak-tested with all valves open. The complete system shall be evacuated with a vacuum pump. Each system shall be charged with the refrigerant as specified in the Manufacturer Engineering Summary. The Contractor shall be responsible for test and adjustment of each condensing unit to make the total system operational.
    b. Electrical Contractor. Electrical Contractor (E.C.) shall provide main power for refrigeration package and all control and defrost wiring as called for in the Manufacturer wiring diagram. E.C. shall also connect drain-line heater in freezer. All electrical wiring installation shall be in accordance with the Manufacturer wiring diagram and local codes.
    c. General Contractor. The General Contractor shall provide the following:
        1) Verify all dimensions and coordinate with all other trades.
        2) Provide and prepare the pitch-pans and platform or rails as called for in the R-1 drawing.
        3) Complete weatherproofing around and under unit.
        4) On-site concrete coring for refrigeration piping.
        5) Crane or hoist services as required for placement of the refrigeration unit and/or other required materials.
    d. Plumbing Contractor: shall provide type "L" copper drain-lines for walk-in refrigerator and freezer, pitched 1/4" per foot of run. Drain line shall be "P: trapped outside of refrigerated space to avoid entrance of warm, moist air or vermin. Contractor shall provide individual drain lines, with Electrical heat tape for each evaporator coil unless otherwise specified in the R-1 drawing. All plumbing installation shall be in accordance with local codes.

B. When non-rack system is specified:
1. Compressors: Heavy duty, noiseless unit with required starting switches and supplied by approved manufacturer. Provide complete with copper tubing dehydrated and sealed at time of installation with pressure switches, line dryers, dehydrators and sight glasses.
    a. Fully wrap and adequately support refrigerant lines extended from compressor locations to individual units. Individually run suction and pressure lines and individually wrapped with fire rated wrap.
2. Motors: Accessible hermetic type utilizing suction gas cooled motor principle with built-in thermal and electric overload protection in motor compressors. Supply each motor with thermal breaker switch installed.
    a. Provide motors with contactor’s definite purpose type. Install contactors on surface free of excessive vibration in electrical enclosure on rack unit.
3. Refrigeration System: Balanced, remote, packaged, internally prewired, and pre-piped, pressure tested, and pressure sealed systems designed to accommodate specified refrigerated equipment requirements. Provide complete system including, but not limited to:
    a. Evaporator coil assemblies.
    b. Condensing unit assemblies.
    c. Motor starters.

d. Refrigerant piping.
e. Insulation.
f. Temperature controls.
g. Related fittings, gauges, valves, regulators, refrigerant, and oil requed for a complete operating system.

4. Evaporator Coil Assemblies: Provide coil, fan, drain pan, expansion valve, temperature control, heat exchanger, and standard components. Furnish coil units to equipment manufactures required for mounting in equipment during fabrication or installation.
5. Refrigeration Tubing: Provide Type L,AC hard draw degreased, sealed copper with horizontal runs sloped 1” per 20 feet (609.6 cm) toward refrigeration circuit or to local code. Support refrigerant piping with adjustable hangers spaced and adjusted to drop required. Where vertical runs of more than 5 feet (152.4 cm) occur in suction line, trap riser at bottom. Install piping so refrigerant or oil cannot drain back into coils from suction line.
6. Insulation: Insulate refrigerant lines with minimum ½” thick fire rated foam insulation for medium temperatures and ¾” thick fire rated foam insulation for low temperatures or equivalent cellular type insulation. Joints between section of insulation shall be glued and taped.
   a. Provide metal pipe sleeves where piping passes through wall, ceiling, or floor. Fill space around tubing with mastic insulation compound.
   b. Utilize EPA and DOE approved refrigerant
7. Drain Line: Coordinate PC to supply Type L supported copper drain line from each coil outlet, 1” away from surfaces to a point 1” above floor sink where shown on rough-in plan provided under other work. Verify brass union and clean-out connection at coil outlet to allow repair, service, and verify replacement has been installed under other work.
   a. Immediately trap drain lines above floor sink.
   b. Paint exposed drain lines with 2 coats chrome paint.
   c. Verify freezer drain line has been wrapped with continuous electrified heater tape provided by EC.
8. Valves: Provide approved standard weight valves suitable for service and purpose intended.
   a. Expansion Valves: Installed in refrigeration liquid line where entering evaporator. Provide external equalizer expansion valves for coils fitted with refrigerant distributor.
   b. Solenoid Valves: Provide line voltage, manual lift system type to operate at maximum 2 point pressure drop across valve; of full refrigerant line size, using silver solder connections as applicable.
      1) For normally closed liquid line solenoid, provide with temperature controller for each coil on system.
9. Dehydrator or Dryer: Provide at compressor assembly. Install in liquid line.
10. Pressure: Pressurize systems to manufacturer requirements and local code. test for leaks.
    a. Perform testing on insulated piping prior to application of insulation.
    b. After testing, establish deep vacuum of 29 inches (736.6 mm) or 50 microns and hold for 24 hours minimum, with maximum decrease of 3 inches (76.2 mm) of vacuum. Assure evacuation time is adequate for removal of internal moisture.

C. Beverage Refrigerators:
1. General Contractor is to Furnish and install beverage refrigerators as shown on the drawings.
2. Field coordinate space, electrical connections for installation.
3. Acceptable product, no substitutions:
   a. Manufacturer: Avanti.
   b. Product: 3 Cubic Foot Refrigerator.
   c. Product Number: BCA30622-IS
   d. SKU: 132728.
   e. Dimensions: 33.75"H x 18.75"W x 19.5"D
   f. Material: Stainless Steel.
   g. Color: Silver/Gray.
   h. Door type: Glazed.

2.05 FAUCETS, VALVES, FITTINGS, AND ACCESSORIES

A. Furnish faucets, rotary handle wastes, basket wastes, open wastes, and strainers for installation by others.

B. Faucets: For each sink, provide faucet with ball check to prevent cross flow of hot and cold water.
   1. Specialized Faucets: Specified under item where intended for use.

C. Gas Fired Equipment: At initial installation, PC to provide gas fired equipment with proper gas pressure

D. Finished: For exposed to view accessories, PC to provide chrome plated piping, fittings, escutcheons, valves, supports, hangers, and similar accessories installed in conjunction with kitchen equipment. Accessories painted with dull aluminum spray paint are acceptable.
   1. Exposed to view applies to piping from the point piping leaves the wall, ceiling, or floor construction to the point of final connection to kitchen equipment or fixtures.
   2. Piping built into fixed counter with concealing doors is not considered exposed.

2.06 FABRICATION

A. Welding: Perform welding using electric fusion metal arc method. Carbon arc or gas welding is not permitted. Perform welding with welding rod of same composition as sheets or parts welded. Make welds complete, strong and ductile. Grind off excess metal from joints and finish smooth to match adjoining surface. Provide welds free of mechanical imperfections (gas holes, pits, runs, cracks, similar) and of same color as adjoining surfaces.
   1. Weld joints in tops of fixtures, tables, drainboards, exposed shelving, sinks, and similar items. Continuously butt weld equipment construction of more than 1 piece of sheet metal. Grind welds smooth and polish.
   2. Provide welded joints homogeneous with sheet metal. Where sheet sizes necessitate a joint, weld joint. Fabricate tops of fixtures in factory with welded joints to reduce field joints to a minimum. Where fixtures join, continuously weld top of fixture joints, except for field joints.
      a. Field Joints: Closely butt, pull together, field weld, grind and polish smooth.
      b. Tops of Fixtures: Fabricate to a maximum length with welded factory joints to bring fixtures to final position and reducing field joints to minimum. Where welds occur on surfaces and are not finished by grinding and polishing, factory coat welds and discolored areas with metallic base paint to prevent progressive corrosion to joints.
   3. Soldering and brazing: Soldering and brazing stainless steel surfaces which can be welded is not acceptable.

B. Grinding, Polishing, and Finishing:
   1. Grind welded exposed joints flush with adjoining material and neatly finish to harmonize with surrounding area. Where material is sunken or depressed by welding operation, grind depression and peen flush to adjoining surface. If necessary, again grind to eliminate low spots. Polish and buff ground surfaces to match adjoining surfaces consistent with good workmanship.
      a. Exercise care in grinding operations to avoid excessive heating of metal and metal discoloration.
      b. Remove grain or rough grinding by successive polishing operations.
      c. Verify texture of final polishing operation is uniform and smooth.
      d. Provide high grade finish for equipment
   2. Butt Joints: Confirm code allowance requirements. Make butt joints and contact joints close fitting, not requiring solder as filler.
      a. Soldering where dependence is placed solely on soldering for strength and stability of joint or fixture is not permitted.
      b. Where brake bends occur, make free of under extrudence. Where brakework mars uniform appearance of material, remove marks by grinding, polishing, and finishing.
      c. Where sheared edges occur; make free of burrs, fins or irregular projections. Finish sheared edges.
      d. Where miters of bull nosed corners occur, neatly finish with under edge of material ground to uniform condition. Overlapping materials is not acceptable.

3. Provide equipment with quality finish, consistent with high grade manufacturing practices and free of sharp edges or corners.
    a. Exposed surfaces: Provide #4 finish. Exposed surface includes inside surface exposed to view when sliding or swinging door is opened. Finish underside of shelf equal to #180 ground finish. Final #4 finish is factory finish not finish furnished by mill. Indications of die markings not blending with final finish are not acceptable.

C. Corrosion Protection:
1. Where welding operation occurs on stainless steel, take measures to eliminate possibility of corrosion. Weld bolts and screws using industry standard process that eliminates possibility of carbide precipitation. Finish each welded joint in bright finish to eliminate progressive corrosion. Grind or coat underside of each weld to prevent possibility of oxidation and progressive corrosion.
2. Welding performed by process which eliminates or reduces carbide precipitation in connection with bolts and screws need not be treated. Treat welded joints to prevent progressive corrosion.
3. Where welded framing, or galvanized or tinned angle or channel construction is specified, perform welding prior to hot galvanizing. If galvanized structural sections are used, treat welded joints with metallic coating to cover surfaces marred by welding and grinding operations. Clean iron or galvanized pipe and other parts and finish in the factory with minimum 2 coats of NSF approved gray spray.

D. Bolt Construction:
1. To the extent possible, provide exposed surfaces free of bolts, screws and rivet heads. Where bolts are used to fasten trim to paneling or body of warmers, cabinets, counters, similar items, and to fasten tops of counters, dish tables to top of framing, use concealed type bolts and screws.
2. Where threads of bolts and screws occur on inside fixtures, are visible, or might come in contact with hands or wiping cloth, cap bolts and screw threads with lock washer and chrome plated brass or bronze acorn nut. Where screw threads are not visible or readily accessible, cap with standard lock washer and steel nut treated to prevent rusting or corroding.
3. Where bolts or screws are welded to underside of trim or tops, finish reverse side of weld uniform with adjoining surface of trim or top. Depressions are not acceptable.

E. Counter Legs: Provide heavy duty, stainless steel legs.

F. Leg bracing: Provide bracing from front to back, forming H frame. Construct from minimum 1-5/8 inch (41 mm) o.d. x [.083] inch ([2.11] mm) stainless steel tubing except as noted. Run cross bracing horizontal and level between legs, approximately [10] inches ([254] mm) above floor, unless otherwise specified. Completely weld joints around entire perimeter forming complete seal with welds ground and polished smooth to match adjacent work.
1. Rear Bracing: Interconnect H frames or, if required, provide rear single bracing for dish tables, space for bins, carts, or mobile equipment. Secure to adjacent legs with welded joints.

G. Leg Mountings: Where units are mounted on legs 14 inches (355.6 mm) or longer, provide underbracing.
1. Provide legs with sanitary type 12 gauge stainless steel inverted type channel braces full width of respective tops. Channel width: approximately 2-3/4 inches (70 mm)
    a. Vertical Channel legs: 1 inch (25.4 mm) with 7/8 inch (22.22 mm) wide flange; overall width of channel is 4-1/2 inch (114 mm). Round ends of channel and fully enclose by welded stampings matching cross section of channel.
    b. Channel: Projection weld to underside of stainless steel units at intervals of maximum 4 inches (101.6 mm) and at ends maximum 2 inches (50.8 mm) on center. Fully close crevices between flanged channel and underside of unit and sealed off with filler. Provide channel braces receiving supporting legs concentric with legs.
2. Weld stiffening cup in contact with underside of unit and welded to inside of channel. Provide 1-3/8 inch (9.52 mm) o.d. pipe 3-1/2 inches (89 mm) long and weld inside to bottom of channel concentric with legs and centered.

a. Pressure force 1-5/8 inch (41 mm) o.d. pipe over welded pipe and hold in place with ¼ inch oval head stainless steel bolt with lock nut. Verify leg fits tightly against underside of channel, preventing entry of vermin or dirt. Where underside of units are wood construction, bolt channel braces to underside and seal resulting joints with filler.

H. Underbracing: Brace stainless steel counters, tables, drainboards, and dish table tops with inverted type channels, spaced maximum 30 inches (762 mm) on center. Provide channels with double sided tape applied to top of channel meeting top.

I. Feet: Provide legs with stainless steel bullet feet, having integrally formed shaft, with minimum adjustment of approximately 1-1/2 inch (38 mm) without use of threading or adjusting bolts. Completely seal feet at bottom and fit closely between tubular leg support and foot. Construct feet in accordance with NSF standards.

J. Undershelving:
1. Flat Undershelving: Constructed from 18 gauge polished stainless steel. Turn down sides of shelving approximately 1-1/2 inches (38 mm) and under ½ inch, 70 degrees, in channel shape with resulting corners cut out to fit contour of leg. Weld shelving to legs. Reinforce undershelving with 1” x 4” x 1” 14 gauge stainless steel welded channels.
2. Construct removable types of shelving of same material, rolled down on all sides, with corners notched to contour of leg, with resulting notches ground and polished smooth. Construct undershelving in sections of maximum 36 inches (914.4 mm). Where butted against adjoining shelf section, turn down shelving 1-1/2 inch (38 mm) and under ½ inch in channel shape. Provide supporting channel on underside of each shelf section, of size and material specified.

K. Drawers: Set drawers into enclosed 18 gauge stainless steel vermin proof housing, closed on all sides and bottom, with 12 gauge stainless steel channel shaped slides, 4 stainless steel ball bearing rollers, 2 front and 2 rear, auto stops and release catches. Sound deaden drawers.
1. Drawers: 20” x 20” x 5” deep inside dimensions unless otherwise specified.
2. Drawer Inserts: Construct of composition rubber or stainless steel
3. Drawer Fronts: Minimum 16 gauge stainless steel, double pan type, with resulting corners welded, ground and polished smooth. Provide drawer faces with recessed stainless steel pull handles welded to face.
4. Bottom of Housing: Where required, provide additional stainless steel angle guides to accommodate 20” x 20” x ¾” thick white acrylic cutting board with pull handle.

L. Water Inlet Location: Locate above positive water level to prevent siphoning of liquids into water system.

M. Sinks and Drainboards:
1. Construct sinks and drainboards of 16 gauge polished stainless steel with joints welded, ground and polished smooth. Soldering is not permitted in sink and drainboard construction. Extend front and freestanding edges upward 3 inches (76.2 mm) measured at sink edge and rolled rim 1-1/2 inch (38 mm) horizontally and down 1-1/2 inch (38 mm)
a. Verify raised rim at front and ends of drainboard is level and continuous with sink rim and does not follow pitch of drainboard.
2. Round vertical and horizontal corners to radius of approximately 1 inch (25.4 mm) with intersections meeting in spherical sections.
a. For sinks having 2 or more compartments construct double dividing partitions, with fully rounded corners, both vertical and horizontal.
b. Round corners of drainboards on inside to radius of 1 inch (25.4 mm) where rolled rim meets front roll rim.
c. Round back splash on all inside to radius of 1 inch (25.4 mm).
d. Fully round front corners of rolled rim on outside roll concentric with inside of roll.
1)
3. Drainboards: Pitched drainboard 1/8 inch (3.18 mm) per foot toward sink compartments. Provide sinks and drainboards with 8 inch (203.2 mm) high back splashes, level and continuous, not following pitch of drainboards adjacent to walls or adjoining equipment.
a. Bottom: Crease bottoms to sufficient pitch toward waste outlets.

b. Cut openings for hot and cold water faucets into back splashes as required. Construct sinks 12 inches (304.8 mm) deep unless otherwise specified or indicated on drawings.
c. Finish exposed exterior and interior of sinks and drainboards to #4 satin finish.

4. Sinks: For sinks integral with counters, as indicated on plans, same as sinks, weld into place with resulting welds ground and polished eliminating all traces of welding.
   a. Sink Bottom: Provide of each sink compartment with 2 inches (50.8 mm) I.P.S. heavy duty, lever drain, constructed with removable poppet valve, in addition to neoprene “O” ring, affording double security against leakage.
   b. Lever Handles: Construct to adequate length so rod handle will not protrude beyond sink top. Furnish waste outlet with stainless steel strainer plate for pot sinks having overflow compartment. For sink compartments with no overflow, provide with lever drain complete with stainless steel strainer plates.
   c. Where 1-1/2 inch (38 mm) outlet connections are indicated, provide drains with adapter and removable crumb cup strainer baskets. Unless otherwise noted, construct connected overflow with steel perforated plates secured to body of sink so constant water level is 1 inch (25.4 mm) below dividing partitions.
5. Pre-rinse Sinks: Construct the same as sinks. For sinks without Garbage disposals, Provide with perforated baskets of minimum 18 gauge polished stainless steel of suitable mesh and arranged to strain out solids from rinse water. Arrange baskets to be easily removed. Provide basket with suitable handle(s).
   a. For removable type dish slides and guides, provide with frame and cross bars of minimum 1” x ½” stainless steel, resting on angle channel on 4 sides of sink and supporting set of minimum 1” x 1” x 1/8” stainless steel angle slides, arranged and set flush with top of dish tables.
   b. If other slides and glides are used, provide details with base bid.
6. Pre-rinse Faucet Assembly: Provide with each pre-rinse sink. Provide complete faucet and assembly with flexible metal design,
   a. Equip unit with jacket valves to prevent cross flow or back flow of water.
   b. Provide unit with squeeze type faucet control for power spraying. Construct interior of mechanism of stainless steel. Provide with wall type supporting bracket.

N. Stainless Steel Counters:
1. Tops: Minimum 16 gauge single piece polished stainless steel finished in #4 satin finish, with resulting edges rounded with no burrs or excess material. Turn down edges 2 inches (50.8 mm) at 90 degree and under ½ inch in channel shape on exposed sides with 1-1/2 inch (38 mm) overhang.
   a. Where counters are placed against walls, turn up back and ends 6 inches (152.4 mm), return back 2 inches (50.8 mm) @ 45 degree angle, and down ½ inch for securing to wall with exposed ends closed, welded and polished smooth.
   b. Cove vertical and horizontal joints ¾ inch radius, terminating in fully coved intersections fully welded, ground and polished smooth to match the top surface.
   c. Reinforce underneath with inverted type channel of minimum 14 gauge stainless steel, spaced maximum of 30 inches (762 mm) o.c. for tables 6’0” and longer, provide 1-1/2” x 1-1/2” x 1/8” thick stainless steel angle framework reinforcing edge, with cross channel every 30 inches or less.
2. Body: Minimum 18 gauge polished stainless steel finished in #4 finish, with resulting edges rounded with no burrs or excess material.
   a. Minimum 2 inch (50.8 mm) wide vertical mullions turned back 1 inch (25.4 mm)
3. Shelves: Minimum 18 gauge polished stainless steel finished in #4 satin finish, with resulting edges rounded with no burrs or excess material.
   a. Turn down front edge of intermediate 1-1/2 inches (38 mm) at 90 degrees and back ½ inch @ 45 degrees.
   b. Turn down bottom shelf 1-1/2 inch (38 mm) at 90 degrees with ½ inch back @ 45 degrees.

c. Back and ends of shelves turn up 2 inches (50.8 mm) at 90 degrees with ¾ inch radiused cove at horizontal and vertical intersections fully welded, ground and polished to match shelf surface.

4. Legs: Heavy-duty stainless steel with adjustable stainless steel feet.

O. Work Counter or Table Top Sinks:
1. Construct sinks of same gauge and material as counter tops. Continuously electrically weld top perimeter of sink to edge of opening in table or counter top. Grind and polish smooth resulting welds so sink and top are integral units. Die punch table or counter top to ¾ inch faucets.
2. Round vertical and horizontal corners to 1 inch (25.4 mm) radius with bottoms pitched to 1-1/2 inch (38 mm) or 2 inch (50.8 mm) waste outlet as indicated on plan.
3. Hang work counters and tabletop sinks by hanger clips.
4. Match finish and appearance of sinks with table or counter top.

P. Stainless Steel Table Tops: Minimum 16 gauge polished stainless steel finished in a #4 satin finish, with resulting edges rounded with no burrs or excess material. Turn down tops 1-1/2 inches (38 mm) and under ½ inch in channel shape on exposed sides. Where tables are placed against walls, turn up in back approximately 6 inches (152.4 mm), returned 2 inches (50.8 mm) at 45 degrees to wall with exposed ends closed, welded ground and polished smooth.
1. Cove vertical and horizontal joints on ¾ inch radius, terminating in fully coved intersections thoroughly welded, ground and polished smooth to match top surfaces.
2. Tops: Construct of single pieces of stainless steel and reinforce underneath with inverted type channel of minimum 14 gauge stainless steel, spaced maximum 30 inches (762 mm) o.c.
a. For tables 6’0” and longer, provide 1-1/2” x 1-1/2” x 1/8” thick stainless steel angle framework reinforcing edge, with cross channels every 30 inches (762 mm) or less.

Q. Insets: Minimum 18 gauge stainless steel fully coved. Provide full complement of insets with covers, of sizes and patterns specified, with equipment as necessary. Insets include but not limited to stainless steel pans. Additional covers are provided by owner.

R. Elevated Shelves: 18 gauge polished stainless steel with working side turned down 2 inches (50.8 mm) and under ½ inch in channel shape with resulting corners welded, ground and polished smooth. Turn up ends and back approximately 2 inches. Round upturned edges at ends and in front and finish smooth.
1. Mount shelves on minimum 12 gauge stainless steel cantilever brackets secured to wall by means of chrome plated toggle bolts and expansion shields.
2. Position brackets 3 inches (76.2 mm) clear of wall at ends.

S. Sliding Doors: 18 gauge polished stainless steel exterior and 20 gauge stainless steel interior. Equip doors with die stamped recessed stainless steel pull handles. Provide removable doors constructed of double pan construction, filled with sound deadener ½ inch thick with corners welded, ground and polished smooth to uniform finish.
1. Construct doors to permit removal for cleaning or adjustment without use of tools. Keep bolts and screws to minimum and of corrosion resisting metal.
2. Spacers (Not Exposed To View) 14 gauge ¾ inch diameter; with upper suspension stainless steel rollers to be heavy duty and ground to minimize wear and noise. Take precaution to avoid friction or rubbing between doors, door suspensions and upper sliding framework, including hardware.
3. Double Doors: Provide with double overhead tracks and carriers for maximum clear door opening. Provide units with trackless bottom with concealed guide for overhead roller doors. Equip guides with limit stops to prevent telescoping of doors.

T. Hinged Doors: 18 gauge polished stainless steel front with 20 gauge stainless steel pan shaped backs, with corners welded, ground and polished smooth.
1. Hinges, Catches and Locking Devices: Chrome plated brass.
2. Hinges: Stainless steel lift off type construction to eliminate exposed bolts and screw heads.
3. Door Handles: Stainless steel, flush mounted. Locking devices as indicated.
4. Hinges: Stainless steel lift off type.

U. Counter Shelves, Cabinet Shelves, and Overhead Cabinet Shelves: 16 gauge polished stainless steel.
   1. Overhead Cabinet Shelves: 18 gauge polished stainless steel.
   2. Shelving: Removable type, finish in #4 satin finish and constructed in sections of maximum 30 inches (762 mm). Where shelves are higher than 5’0” above floor, finish underside of shelf same as top. Fabricate shelves to be removable for cleaning, except where specified as fixed. Perforate warmer shelves and construct as removable.

V. Angle Mountings: Provide fixed equipment adjacent to walls with front legs and rear wall mounting.
   1. Provide stainless steel tables adjacent to walls with 6 inch (152.4 mm) high back splashes, returned 1-1/2 inch (38 mm) to wall with welded closed ends.
   2. Support return of tops with 1” x 3”, 12 gauge stainless steel angle, fastened to wall with lead shields and chrome plated lag screws.

W. Wall Cabinets: Provide wall cabinets in lengths indicated on plan or length specified x 13 inches (330.2 mm) deep and 36 inches (914.4 mm) high, except where shown otherwise on drawings. Provide sloped, dust proof tops. Construct exterior bottoms to be flush type.
   1. Construct from 18 gauge polished stainless steel, all welded construction. Provide cabinet interiors with fixed bottom shelf and 2 removable, adjustable, intermediate shelves. Rest shelves on clips secured to stainless steel keyholes strips fastened to interior of cabinet.

X. Floor Troughs:
   1. Trough: floor troughs to be 14 gauge type 304 stainless steel in #4 finish. Troughs to be fabricated to accommodate Stainless steel or Chemgrate Chemtread grates. Troughs to be a minimum of 4” deep pitched ½” per foot of length to 4” drains. Drains to be located a minimum of every 12’-0”. Maximum length of trough pitch to be 6’-0”. Troughs to have ¾” fully coved, welded and polished corners. Each drain shall have a removable perforated stainless steel basket held in a stainless steel waste cup. Profile of top edge as per plans. Coordinate height of finished floor with General Contractor and fabricate frame accordingly. Trough must be flush with finished floor.
   2. Grate: Chemgrate gratings follows:
      a. The tread shall be fiberglass roving reinforced polyester 1-1/2” high, having a grid pattern with bearing bars 1-1/2” and cross bars 6” on center.
      b. The tread shall be made in a mold and of single piece construction so the reinforcing glass of the bearing bars are interwoven with the reinforcing glass of the cross bars. The solid nose construction shall be made integral with the tread and shall be 1-3/4” wide.
      c. Angular white silica particles shall be integral molded in the top portion to provide an anti-slip walking surface.
      d. All grates to be maximum length of 48-1/2”. Any grates shorted than 48-1/2” shall be cut flush at a cross bar.
   3. Floor troughs to be provided by KEC and installed by GC unless otherwise noted

Y. Shipping:
   1. Totally assemble all equipment at factory before shipping and delivery.
   2. Mark all disassembled equipment.
   3. Properly number.
   4. Provide drawings and instructions for re-assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Rough In Work: Examine roughed in utility services, installation of floors, walls, columns, and ceilings, and conditions under which food service work is to be installed; verify dimensions of services and substrates before fabricating work. Notify Architect of unsatisfactory locations and dimensions of work and of unsatisfactory conditions for proper installation of food service equipment. Do not proceed with fabrication, purchasing and installation until unsatisfactory dimensions and conditions have been corrected.

B. Accessories: Verify accessory items required have been provided.

3.02 INSTALLATION

A. Provide all labor, materials, equipment, services and transportation required to furnish, set in place and make ready for final utility connections by others all food service equipment. Note: Existing equipment will be disconnected and set-in-place by contractor.

B. Install equipment in accordance with manufacturer's instructions and recommendations.

C. Receiving and Installation of exhaust hoods and floor troughs by General Contractor.

D. Set each item of non-mobile and non-portable equipment securely in place, level, and adjust to correct height. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorage's where possible. Adjust countertops and other surfaces to level tolerance of 1/16 inch (1.59 mm) maximum offset, and maximum variation from level or indicated slope of 1/16 inch per foot.

E. Where indicated or required for safety of equipment operator, anchor equipment to floor or wall. Where equipment is indicated to be anchored to floor, provide legs with adjustable flanged foot. Install 2 anchors on each foot.

F. Free Standing Equipment: Place units in final location after finishes have been completed in each area. Verify clearances are adequate for proper operation of equipment.

G. Field Joints: Complete field assembly joints in work (joints cannot be completed in shop) by welding, bolting and gasketing, or similar methods as indicated. Grind welds smooth and restore finish. Set or trim gaskets flush, except for T gaskets as indicated.

H. Closure Plate and Strips: Install where required, with joints coordinated with units of equipment.

I. Cutouts: Provide cutouts in food service equipment where required to run plumbing, electric, gas, or steam lines through equipment items for final connections.

J. Sealant and Gaskets: Install around each unit to make joints airtight, watertight, vermin proof, and sanitary for cleaning purposes. Make sealed joints minimum 1/8" wide and stuff backer rod to shape sealant bead properly at ¼" depth.

3.03 FIELD QUALITY CONTROL

A. Testing: Start up and calibrate food service equipment after service lines have been cleaned, tested, balanced, and adjusted for pressure, voltage, and similar considerations. Do not operate steam lines until cleaned and treated for sanitation. Before testing, lubricate each equipment items in accordance with manufacturer's recommendations.

B. Start-up, check, adjust, and calibrate equipment furnished and installed. Repair or replace equipment and parts that do not function properly.

C. After equipment is operating properly, schedule with the Owner's Food and Beverage and Engineering Personnel a demonstration of equipment operation, cleaning and maintenance.

3.04 CLEANING

A. After completion of installation and major work in food service areas, remove protective coverings and construction clean food service equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch up painted surfaces. Replace work that cannot be successfully restored.

B. Final Cleaning by Owner: After testing and start-up, and before Substantial Completion inspection, clean and sanitize food service equipment, and leave in condition ready for use in food service.

C. Legally remove and dispose waste and surplus material, and rubbish from site.

3.05 CLOSEOUT PROCEDURES

A. Contract Closeout Procedures: Submit written certification that Contract Documents have been reviewed, work inspected, and work has been completed in accordance The Contract Documents, and ready for inspection.

B. Provide services of Installers technical representative, and manufacturer's technical representative where required, to instruct Owner's personnel in operation and maintenance of food service equipment.

C. Schedule training with Owner; provide at least 7 day notice to Architect of training date.

D. Tag all keys and turn over to owner.

E. Project Record Documents: Maintain on site, 1 set of Contract Documents, Shop Drawings, and Product Submittals to be utilized for record documents.
   1. Record actual revisions to the work concurrent with construction progress.
   2. Specifications: Legibly mark and record at each section, a description of actual products installed.

F. Record Documents and Shop Drawings: Legibly mark each items to actual construction.
   1. Submit documents.

G. Warranties: Execute and assemble documents from subcontractors, suppliers, and manufactures.

3.06 EQUIPMENT SCHEDULE

A. See following pages.

END OF SECTION

SECTION 11 66 00
ATHLETIC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work of this section includes, but is not limited to the following: Include, in the bid, for each item listed, all labor, materials, equipment costs and miscellaneous items required for a complete installation.

B. Provide fixed and portable athletic equipment and items as shown on the drawings and in the specifications.

C. Provide brackets, hangers, supports, pedestals and anchorage necessary to mount or suspend equipment in a neat, safe and permanent manner.

D. Products include:
   1. Stationary Basketball backstops, manual adjusters, backboards, goals and nets. (Kid's Gym)
   2. Wall Padding:
      a. Wall fittings.
      b. Interior Wall padding.
      c. Exterior Wall padding.
      d. Protective guards.
   3. Alpha Rack Divider Panels.
   4. Traverse Wall.

1.02 RELATED SECTIONS

A. Division 00 - Procurement and Contracting Requirements, Contract Forms and Conditions of the Contract.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 01 92 00 - Facility Operation and Maintenance.

F. Section 05 40 00 - Cold Formed Metal Framing.

G. Section 05 50 00 - Metal Fabrications.

H. Section 06 10 00 - Rough Carpentry.

I. Section 08 81 00 - Glazing.

J. Section 09 21 16 - Gypsum Board Assemblies.

1.03 RELATED REQUIREMENTS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. NCAA (BR) - Men's and Women's Basketball Rules and Interpretations; current edition.

C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

A. Product Data: For each item specified, including attachments and installation data.

B. Shop Drawings: Show details of fabrication and installation, including dimensions and location of each item. Provide details for anchoring and show relationship with, attachment to and reception of related items.

C. Procurement:

1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

D. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum of five years successful experience in the manufacturer of the type of respective product specified. Manufacturer shall be represented by a local agency to provide maintenance and service of specified equipment.

B. Equipment shall be provided by a single source manufacturer in order to establish and assure a consistent warranty/service policy.

C. Installer: Minimum of three years successful experience in installation of the type of respective items specified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Items shall be delivered to Project site in undamaged condition.

B. Do not deliver items to Project site until building is enclosed, other Work within the spaces is substantially complete and installation of all items within that space is ready to begin.

C. Store as recommended by manufacturer’s written instructions and in original protective packaging until time of installation.

1.07 OPERATION

A. Instruct Owner’s personnel in proper operation of items as necessary. Provide operating and maintenance manuals.

1.08 REFERENCES

A. All equipment shall conform to the latest rules and regulations of the National Federation of State High School Association (NFSHSA) and the National Collegiate Athletic Association (NCAA (BR)).

B. Submit manufacturer’s Certificate of Insurance.

1.09 WARRANTY

A. Provide one-year warranty against defects in materials and workmanship. Provide lifetime warranty on all backboards. Backstop structure without said warranty will not be approved as equal. Extended Warranties shall be in force on other items as listed in product specifications.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Refer to manufacturer’s latest printed specifications for details not covered herein.

B. Stationary Backstop: Wall-braced, single post, ceiling hung stationary basketball backboard. Model 3115, Performance Sports Systems/Gared Sports, Noblesville, IN; or approved equal.
1. Paint all support steel PT-5.
2. Vertical support to be 6-5/8” diameter vertical mast. Vertical mast shall be stabilized by rectangular tube side sway braces welded to the support channel and the mast.
3. Mount goal directly through backboard and into steel flange at lower extension frame.
4. Field verify heights and dimensions.

C. Manual Basketball Backstop Height Adjuster: Model No. 1131 Manual Adjust-A-Goal by Performance Sports System/Gared Sports, Noblesville, IN.
1. Height adjuster shall be manufactured of steel using an Acme threaded screw rod with awning type hand crank to raise and lower backboard. Height adjuster shall be screw driven to raise and lower goal with a range of 2’-0” (6’ to 8’, 7’ to 9’ or 8’ to 10’ off of finished floor). Screw drive shall be a 3/4’’ Acme double-start threaded rod secured in two bronze bushings. Height adjuster shall

be operated from floor by hand crank (included with height adjuster). Height adjuster shall be directly attached to backboard support structure.

D. Backboard, Kid's Academy Gym: Official size 3'-6" x 6'-0" x 2 1/8" thick. Model AFRG42E by Performance Sports Systems/Gared Sports; or approved equal.
   1. Meet all NCAA and NFHSA requirements.
   2. Frame shall be welded, unitized construction fabricated from heavy wall, rectangular steel tubing. Include a vertical center strut mounted directly through the glass and into the rear frame.
   3. Glass shall be ½" thick, fully tempered (heat treated) with uniform load and impact strength. Provide official white border and target area permanently "fired-in" to front side of glass. Secure glass to unitized rear frame by L-shaped steel, perimeter frame-finished in gray powder-coat finish. Provide manufacturer's lifetime warranty.
   4. Backboard Padding: pre-molded square corners and locking bolt-on attachment system 2" thick. Model PMCE Pro Mold Cushion Edge by Performance Sport Systems/Gared Sports; or approved equal. Minimum 5 year warranty.
      a. Color: Black.
   5. Goal: Model No. 1000 Scholastic Breakaway Goal, manufactured by Performance Sports Systems/Gared Sports, Noblesville, IN; or approved equal.
      a. Goal shall be designed to absorb shock loads and incorporate a positive lock, pressure release mechanism that is field adjustable without removing housing cover and providing 35 to 50% energy absorption. Rim shall be fabricated from 5/8" diameter, high strength, and cold drawn alloy steel, round formed to an 18" inside diameter ring. Inside of ring shall be positioned 6" from face of backboard, by heavy L-shaped, formed steel mounting whole centers for front mounting.
      b. Rim shall be provided with 12 "no tie" net attachment clips.
      c. Entire assembly shall support minimum 800 pound load on outer edge and flex under extreme dynamic loading up to 2 ¾" without permanent set or deformation.
      d. Finish shall be a durable, official orange powder coat finish.
   6. Net: Anti-Whip Pro Basketball Net, Product No. AWP by Performance Sports Systems/Gared Sports, Noblesville, IN; or approved equal.
      a. Net shall be 120 count nylon, hourglass design.

E. Wall Padding:
   1. Interior Wall Padding:
      a. Acceptable Manufacturers and Products:
         1) FR SAFPAD; fire retardant safety wall pads: Porter Model 345-300.
         2) AK Athletic Equipment: Flame Safe Class A Wall Pad.
         3) Or approved equal.
      b. Padding shall meet the NFPA 101; Sections 6-5.3.1.2 and 6-5.5.1.
      c. Class A rating of 0-25 flame spread and 0-450 smoke development for use on interior walls and ceilings. Laboratory tests shall be furnished to verify the pad assembly meets or exceeds ASTM E84.
      d. Pads shall be 2'-0" wide, height as indicated in drawings. Panels shall be constructed with a flame retardant, 2" thick, neoprene foam filler with a density of 5.5 lbs/ft. and an Indentation Force Deflection (IFD) of 25-45 pounds.
      e. Interior foam shall be bonded to a 7/16" OSB Entire face, including nailing margins, shall be upholstered with a 14 ounce fire retardant vinyl laminated, high tensile, polyester base fabric material. Colors shall be a specified in "Interior Finish Schedule." Any exposed backing material is to be painted Black.
      f. Cutouts shall be field made. Installer shall be responsible for proper inspection and installation.
   2. Wall Pad Coverings:
      a. Acceptable Manufacturers:
         1) Value Vinyls.
         2) AK Athletic Equipment.

3) Or approved equal.

b. Wall Pad Types:

1) WP-1

(a) Basis of Design:

(1) Manufacturer: Value Vinyls.

(2) Collection: Champion MVP 14.

(3) Color: Camel.

(4) Finish: Leather.

(b) Or approved equal.

(c) Weight: 14 oz.

(d) Size: See Drawings

(e) Location: Kids Academy Tumbling Studio.

(f) URL: https://www.valuevinyls.com/all-fabrics/champion-mvp-14/

3. Exterior Wall and Fence Padding:

a. Vinyl Covering: 18 oz./sq. yd. Vinyl, UV & Weather Resistant.

b. 3" Thick Polyurethane High Impact Foam.

c. 3/4" Marine Grade Plywood.

d. Steel Backup Plates and fasteners: By manufacturer to fasten to chain link fence, wall or other substrate as indicated on drawings.

1) WPX-1

(a) Manufacturer: Douglas Industries. Or approved substitution.

(b) Product: Douglas Bolt & Backup Plate Plywood Backed Field Wall Padding.

(c) Color: Gray.

(d) Size: See drawings.

(e) Finish: Standard.

(f) Location: As shown on drawings.

F. Wall Attachment Clips: Install a wall attachment system to allow removal of panels.

1. Clips shall be heavy, precision extruded aluminum (6063-T5) with attachment holes pre-drilled.
2. Z Clip Channel: No. 00347-300; 6’-0” long, for mounting either on the wall to accept the lower 1” lip or a snap-in type trim for the top lip when used with Wall Attachment Clip below. Z clip shall be pre-drilled with 13/64” diameter holes on 9” centers.
3. Wall Attachment Clips: No. 00347-100 – 6’-0” long and may field cut to required length. Provide pre-drilled 13/64” diameter holes at 9” on center.

G. Guards: Heavy duty, steel frame. Double-hinged on one side with wing-nut fastener on opposite side. Install per manufacturer’s instructions. Exterior Wall Padding: Provide materials specifically made for outdoor use. Wall padding shall consist of a 2-inch foam filler laminated to an exterior treated paneling and covered with a 17.5 oz Class “A” Flame retardant vinyl laminated polyester on full surface, sides, ends and including all wood edges with the bottom vinyl edge having #3 brass grommet weep hole inserted along it.

1. Backer Board: Not less than ½” exterior treated plywood or other exterior treated paneling.
2. Foam Filler: Not less than 2-inch thick polyurethane foam filler.
3. Vinyl Covering: 17.5 oz Vinyl Laminated Polyester, Achieving NFPA 701 CSFM, and a Class “A” fire rating under ASTM E84, with a “smoke developed” index of 450 or less and a “flame spread” index of 25 or less.

a. Exterior Vinyl Color: To be selected from manufacturers standard color chart.

H. Alpha Rack Divider Panels:

1. Metal Frame provided by owner, installed by contractor.
2. MDF Panel by millwork provider.
3. Frameless mirrors by glazing provider.
4. Coordinate work with that of sections 05 50 00, 06 40 00, 08 81 00 and with details found in Casework Book.

2.02 TRAVERSE WALL

A. Traverse Wall:
   1. Manufacturer: Everlast Climbing Industries Inc (https://everlastclimbing.com/)
   2. Product: Magna Traverse Wall.
   3. Surface: Magna.
   4. Dimensions: See Drawings.
   5. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
   6. Location: Studio - Movement.

B. Traverse Wall Mats:
   1. Manufacturer: Everlast Climbing Industries Inc.
   2. Product: Traverse Wall Mats.
   3. Color: Gray
   4. Dimensions: To match length of Climbing Wall.
   5. Quantity: 1.
   6. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
   7. Location: Studio - Movement.

C. Traverse Wall Accessories:
   1. Safari Plank Wall with mats.
      a. Manufacturer: Everlast Climbing Industries Inc.
      b. Color: Gray.
      c. Quantity: 1.
      d. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
      e. Location: Studio - Movement.
   2. Safari Wild Web with mats:
      a. Manufacturer: Everlast Climbing Industries Inc.
      b. Color: Gray.
      c. Quantity: 1
      d. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
      e. Location: Studio - Movement.
   3. Traverse Wall Challenge Course:
      a. Manufacturer: Everlast Climbing Industries Inc.
      b. Quantity: 1
      c. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
      d. Location: Studio - Movement.
   4. Versa Challenge Course:
      a. Manufacturer: Everlast Climbing Industries Inc.
      b. Quantity: 1.
      c. Contact: Tim Sudeith, tim.sudeith@everlastclimbing.com
      d. Location: Studio - Movement.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine work on which specified work is in any way dependent to ensure conditions are satisfactory for installation. Report in writing to LTF Construction any defects which may influence completion of specified work. Absence of such notification will be construed as acceptance of work in place. Do not attempt installations until correct conditions are present or you have a written order to do so.

B. Equipment herein specified shall be installed by factory trained craftsmen skilled in their trade. They shall be responsible for accurate fit to specified work.

3.02 ERECTION

A. Coordination:

1. Coordinate installation with LTF Construction's schedule to ensure orderly and timely progress of the total work.
2. Placement of equipment relating to floor groove lines shall be coordinated with Work under Flooring Section.

B. Basketball Backstops:
1. Install in accordance with manufacturer's instructions and approved shop drawings.
2. Ensure equipment does not interfere with one another and required clearances.
3. Contractor shall adjust backstops and backboards for plumb and level.

C. Alpha Rack Divider Panels:
1. Anchor panels as specified in 05 50 00. Coordinate length of anchors with thickness of isolated slab.
2. Attach MDF board to frame as indicated on details in Casework book.
3. Attach mirror to MDF board as specified in 08 81 00.
4. Coordinate sequence of installation with work of all involved trades and adjacent construction activities.

D. Adjustments: Examine installed equipment for proper anchoring and rigidity and correct as required.

3.03 CLEANING AND TOUCH-UP

A. Thoroughly clean all items of Work in this Section. Touch-up painted members, as required for proper appearance.

END OF SECTION

SECTION 12 00 10
DIVISION 12 TABLE OF CONTENTS

1.01 DIVISION 12 – FURNISHINGS

12 36 00 - Solid Surfacing Countertops and Sills

12 92 00 - Artificial Plants

END OF SECTION

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SECTION 12 36 00
SOLID SURFACING COUNTERTOPS AND SILLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

B. Interior Window Sills as indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 06 10 00 - Rough Carpentry.

F. Section 06 40 00 - Architectural Woodwork.

G. Section 07 92 00 - Joint Sealants.

H. Section 09 21 17 - Gypsum Board Assemblies.Count

I. Section 09 75 00 - Interior Stone.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

F. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Installer's qualification statement.

H. Installation Instructions: Manufacturer's installation instructions and recommendations.

I. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

J. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Natural Stone Institute (NSI) Accredited Natural Stone Fabricator; www.naturalstoneinstitute.org/#sle.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

C. Quality Certification:
1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops and Sills: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Meganite, Inc: www.meganite.com/#sle.
         (a) Contact: Randy Houston randyhouston@meganite.com
      2) No Substitutions permitted.
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. NSF approved for food contact.
   d. Finish on Exposed Surfaces: Same as top surface..
   e. Colors by type:
      1) **AS-1:**
         (a) Color: Himalaya M601.
         (b) Edges: 1/8" radius eased at top exposed edge. Polished back at underside.
         (c) Ends: Extend beyond opening same distance as overhang and finish ends to match exposed edge.
         (d) Location: Window Sills.
      2) **AS-2:**
         (a) Color: Mt. Vancouver M002

(b) Edges: 1/8" eased at top exposed edge. Polished back at underside.
(c) Location: Dispensary.

3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Back and End Splashes: Same sheet material,eased top; minimum 4 inches (102 mm) high.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined. Color to match surface material.

D. Joint Sealant: Mildew-resistant silicone sealant, clear. See section 07 92 00.

2.03 CUTOUTS AND HOLES:

A. Under-counter Fixtures: Make cutouts for under-counter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   1. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.

B. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

C. Fittings: Drill countertops in shop for plumbing fittings, under-counter soap dispensers, and similar items.

2.04 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:
   1. See drawings and Section 05 50 00.

2.05 FABRICATION

A. Fabricate tops, sills and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Cut according to Manufacturer's recommendations. 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.

C. Seal joint between back/end splashes and vertical surfaces.

3.03 CLEANING

A. Clean countertops surfaces thoroughly.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 92 00
ARTIFICIAL PLANTS

PART 1 GENERAL

1.01 SUMMARY

A. Provide artificial green walls as indicated on Drawings.
   1. Interior Artificial Green Walls.

B. Artificial plants for planters are provided by others.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 09 21 16 - Gypsum Board: Wall Substrates.

E. Section 10 14 00 - Signage.

1.03 REFERENCE STANDARDS

A. ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials."

1.04 SUBMITTALS

A. Submit manufacturer’s product data and installation instructions for each type of green wall, with mounting hardware, adhesive and accessories required.
   1. Include data on physical properties, fire hazard classification and fire detection characteristics of wallcoverings.

B. Shop Drawings: Submit shop drawings of green wall, including attachment and coordination with signage, other adjacent features.

C. Submit 6” x 9” samples of each type of green wall specified, inclusive of product name and accessories labeled on the back of each sample.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Submit a copy of maintenance instructions to Owner in accordance with Division 1, Section "Contract Closeout."

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer: Provide each type of green wall required produced by one manufacturer whose published literature clearly indicated compliance of product with specified requirements.

C. Applicator: Installation by skilled applicators certified by Manufacturer to install their product.

D. Fire Hazard Classification: Provide materials that comply with Class A Fire Rating when tested in accordance with ASTM E84.
   1. Flame Spread: 10.
   2. Smoke Developed: 25.

E. Field Test Panels: Install not less than three (3) full-width sheets of each pattern specified in an area designated by the architect and or designer. Review installation area for conformance to manufacture’s standard installation instructions. Maintain approved test area as part of the finished installation work and as a standard of comparison for the installation throughout the project.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver all wallcovering to the job site in the distributor's undamaged packaging clearly labeled and properly identified.

B. Store materials in a clean, dry, protected area where temperature and humidity remain stable and within the ranges specified by the distributor.

1.07 PROJECT CONDITIONS

A. Maintain a constant temperature range of 65 degrees F to 85 degrees F, with not more than 50% relative humidity and not less than the relative humidity specified for the project area in the AWI Quality Standards Section 1700-T-19, for at least 4 days prior to, throughout the installation period and maintained consistently thereafter.

B. Surface preparation: Provide hanging surface that is smooth and free of all excess dust, oils or other foreign matter.

C. Provide the following conditions, according to type of substrate:
   1. Provide Gypsum board finish in compliance AWCI Specification, Level 4.
   2. Finish plaster walls to the manufacturer’s specification and free from undulations and surface defects.

1.08 WARRANTY

A. Submit manufacturer's 1 year written warranty against defects in material and workmanship.

PART 2 PRODUCTS

2.01 MATERIALS: GREEN WALLS

A. Artificial green wall V-6:
   1. Manufacturer and Product: Vistafolia; Luxury Flowering Boxwood
   2. Color: Variegated boxwood
   3. Material UV Stabilized polyethylene, backing materials and installation materials.
   4. Sizes: Custom to locations as identified on plans and details.
   5. Contact: Shaun Lewis, 248-515-7184, shaun@naturescreation.com

2.02 ACCESSORIES

A. Manufacturer's recommended anchors and adhesives.

B. Exterior applications:
   1. Provide Neoprene washers (or manufacturer recommended equivalent) at all penetrations into building wall.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and installation conditions.

B. Test substrates with suitable moisture meter. Verify that moisture content does not exceed 4%.

C. Verify that substrate surfaces are clean, dry, smooth, structurally sound and free from surface defects and imperfections that would show through the finished surface.

D. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.

E. Do not proceed with work until conditions have been corrected.

3.02 PREPARATION

A. Follow Manufacturer's instructions for installation, unpacking and unfolding the foliage.

B. Coordinate with Signage provider and details.

3.03 INSTALLATION

A. Install green walls in accordance with manufacturer’s written installation instructions.

B. Provide recommended anchors.
   1. See details for exterior installations.

C. Install with recommended air space.

D. Install such that similar panels are not adjacent to each other.

E. Install accessory materials randomly, but evenly, around the panels as recommended by manufacturer.

F. Install each sheet in sequential, numerical order, as indicated in Manufacturer's instructions.

3.04 CLEAN-UP COMPLETION

A. Upon completion of the work, remove excess materials, debris and rubbish resulting from the installation and leave the area in a clean and orderly condition.

B. Protect the finished green walls from damage that may occur from other trades until project has been completed.

END OF SECTION

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SECTION 13 00 10
DIVISION 13 TABLE OF CONTENTS

DIVISION 13 – SPECIAL CONSTRUCTION

13 08 00 - Commissioning of Special Construction
13 11 13 - Below Grade Swimming Pools
13 11 15 - Swimming Pool Finishes
13 11 16 - Swimming Pool Piping & Valves
13 11 46 - Swimming Pool Equipment and Accessories
13 24 16 - Saunas
13 24 16.24 - Prefabricated Exterior Saunas

END OF SECTION

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SECTION 13 08 00
COMMISSIONING OF SPECIAL CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Swimming Pools
   2. Swimming Pool Finishes
   3. Swimming Pool Piping & Valves
   4. Swimming Pool Equipment and Accessories
   5. Waterslides
   6. Saunas

END OF SECTION

SECTION 13 11 13

BELOW GRADE SWIMMING POOLS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes work requirements required for the construction of pools with all associated equipment and appurtenances.

B. Related Documents

1. Division 1, GENERAL REQUIREMENTS.
    a. All applicable requirements of Division 1 shall apply and are incorporated into this section by reference. In the event of a conflict, the information contained in Division 1 shall prevail.
2. Section 13 11 15 “Swimming Pool Finishes”.
3. Section 13 11 16 “Swimming Pool Piping and Valves”.
4. Section 13 11 46 “Swimming Pool Equipment and Accessories”.
5. Section 07 84 00 “Firestopping”.

C. Reference Standards

1. The work in the sections of Division 13 is subject to the requirements of applicable portions of the following standards:
    a. National Sanitation Foundation (NSF) International Standard 50 – Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs.
    b. Hydraulic Institute Standards.
    c. IEEE Standards.
    d. NEMA Standards.
    e. NEC Standards.
    f. Underwriters Laboratories (UL).
    g. National Fire Protection Association (NFPA) 70 – National Electric Code.
    h. 2021 International Building Code.
    i. Salt Lake County Health Department, Water Quality Bureau, Environmental Health Division, Health Regulation #2: Design, Construction, and Operation of Pools.
    j. Utah Office of Administrative Rules, Rule 392: Health and Human Services, Population Health, Environmental Health – Rule 302: Design, Construction and Operation of Public Pools.
    k. Virginia Graeme Baker Swimming Pool and Safety Act (VGBA ANSI/APSP/ICC-16 2017).
    l. ADA Standards for Accessible Design 2010.
    m. OSHA Rules and Regulations.

D. Definitions:

1. Pool: The term “pool” or “swimming pool” as used within the sections of Division 13 shall reference all types of aquatic water bodies utilized for recreational swimming, competitive swimming, and therapy and includes swimming pools, spas, wading pools, and splash pads.

E. Qualifications of Pool Contractor (No Exceptions)

1. The Pool Contractor must have had at least ten (10) years experience in the construction of the types of swimming pools herein specified and must list at least five (5) pools of these types. Each pool with a water surface area of not less than these pools, which have been constructed and which, upon investigation, would be found to be completed in a satisfactory manner, in operation at least five (5) years, and incorporate concrete structure, perimeter gutter system, pressure sand filters, and automated chemical controllers.

2. The Pool Contractor shall furnish complete evidence that they have the facilities, equipment, personnel, etc. to complete all phases of this trade division. Prior approval must be obtained before entering into any subcontract for this work. An AIA-A305 Contractors Qualifications Statement shall be submitted with request for approval.

F. Scope of Work

1. The Pool Contractor shall furnish all materials, equipment, and labor required for the complete construction of fully operational pools as detailed within the Drawings and described within these Specifications. It is the Pool Contractor's responsibility to ensure that the pool is constructed in compliance with all referenced standards.

2. Equipment manufacturers and model numbers identified on the drawings and equipment lists are the basis of design. Alternate manufacturers may be considered. The pool contractor is solely responsible for all design coordination or changes required by other trades to accommodate requested alternate equipment.

3. Work Included (furnish all labor, materials, and equipment as required):

   a. Layout of all pools (with General Contractor, as shown within Drawings).

   b. Furnishing and subsequent removal of all equipment, tools, scaffolding, rigging, hoisting, etc. as required for construction of the pools and the installation of any equipment, appurtenances, or accessories.

   c. Excavation as required for all pools. Excavation shall be completed in accordance with the requirements indicated within this Specification, the Drawings, and the geotechnical report and recommendations.

   d. Compaction of the excavated pool subgrade and/or additional subgrade stabilization measures required or recommended within the geotechnical report. The pool subgrade shall be in full compliance with the geotechnical recommendations prior to placement of base material.

   e. Furnish and install pool base material as indicated within the Drawings.

   f. Furnish and install drain tile, aggregate materials, and fabric as indicated within the Drawings and geotechnical report.

      1) Exterior: Connect to and furnish site well. Plumbing Contractor to connect site well to appropriate facilities (install appropriate hub for connection).

      2) Interior: Connect to building drain tile stubs furnished by Plumbing Contractor as indicated within the Drawings.

   g. Trench excavation and backfill for all pool piping in accordance with the geotechnical report.

h. Furnish and install pool piping, valves, and process fittings as required for complete operating pool systems as indicated within the Drawings.

1) Furnish and install all piping, equipment, supports, and anchors as necessary and as required by manufacturer's recommendations.

2) Furnish and install Link-Seals at all piping penetrations in foundation walls, interior building walls and surge tanks (for piping penetrations that are not pre-established and will not be installed prior to concrete wall construction). Pool Contractor shall be on site during forming and placement of reinforcing for any interior building or surge tank walls that require pipe penetrations (to coordinate location with Concrete Contractor). Pool Contractor shall furnish all necessary sleeves for installation by Concrete Contractor and shall furnish and install piping seals within sleeves (or concrete if sleeves are removed) following installation of piping.

3) Pressure test all completed piping systems in accordance with the requirements of this section.

4) Furnish and install valve tags and pipe identification labels indicating system and direction of flow. Install labels on all lengths of pipe between fittings and every ten linear feet (10') on pipe runs longer than fifteen linear feet (15').

5) Furnish and install fire seals at pipe penetrations in all fire-rated assemblies in accordance with Section 13 11 16.

6) Furnish and install pipe insulation within all plenum spaces in accordance with Section 13 11 16.

7) Furnish and install pipe insulation on all cold spa piping that is not buried in accordance with Section 13 11 16.

i. Structural design and construction of cast-in-place concrete pool structures (design-build) including all required formwork, steel reinforcing, and accessories.

j. Structural design and construction of cast-in-place concrete surge tank (design-build) for Outdoor Pools, including all formwork, steel reinforcing, and accessories as indicated within the Drawings.

1) Design loading to include:

(a) Soil pressure on tank lid and walls based on depth of soil noted in aquatics drawings.

(b) Confirm whether backfill material used around surge tank is "select" or "native", and use corresponding at-rest pressure noted in the geotechnical report.

(c) Seismic thrust load from soil as noted in the geotechnical report.

(d) 200 psf overburden live load above tank lid.

(e) 100 psf live load surcharge on soil surrounding surge tank for wall design.

k. Coordinate electrical bonding of the pool structure, accessories, deck equipment, etc. with the Electrical Contractor.

l. Verify that all required electrical, plumbing, health, or building inspections have been completed prior to placing concrete.

m. Backwash pit finishes.

n. Placement and compaction of free-draining granular backfill around pools (to subgrade elevations required for adjacent work) in accordance with geotechnical report.

o. Perform test for water tightness on all concrete vessels, as indicated within this Section.

p. Furnish and install all process equipment and accessories as indicated within the Drawings and Section 13 11 46, and as necessary to construct fully operating pool systems.

1) Pumps: Furnish and install pumps including base plate and concrete equipment pad. Electrical power supply connections by Electrical Contractor.

2) Variable Frequency Drives (VFD's): Furnish and install variable frequency drives including any wall mounting hardware or unistrut support. Electrical power supply by Electrical Contractor. Low voltage control wiring to pump by Pool Contractor.

3) Strainers: Furnish and install strainers including concrete equipment pad.

4) Filters: Furnish and install all filters, face piping, filter equipment (including media), and concrete equipment pad if required or recommended by manufacturer. Furnish and install any additional piping, valves, etc. necessary for a complete filtration and backwash system.

5) UV: Furnish and install ultraviolet disinfection system and concrete equipment pad (if required or recommended by manufacturer). Furnish and install electrical connections between UV unit and control panel. Electrical power supply to control panel by Electrical Contractor.

6) Heat Exchanger: Furnish and install all pool connections to heat exchanger as indicated within the Drawings. Furnish and install thermowells, Y-strainers, pressure gauges, and flow sensor within pool side piping for heat exchanger operation.

7) Furnish and install make-up water connection.

8) Furnish and install fittings to receive thermowells and flow sensors in pool piping for mechanical equipment as indicated within the drawings and equipment lists.

9) Chemical Controller: Furnish and install chemical controller, flow cell, sample stream piping, low voltage wiring connections, etc. Electrical power supply, line voltage connections and chemical feed power relays (if required) by Electrical Contractor.

10) Chemical Feed Pumps: Furnish and install chemical feed pumps, injectors, and tubing. Furnish and install bulk chemical tanks including all required piping connections (quick connect fill piping, connection to venting, level monitor, etc.).

11) Flow Meters: Furnish and install flow sensors and flow monitors as indicated on the drawings. Low voltage wiring connections from sensor to monitor and chemical controller by Pool Contractor.

12) Water Level Controller: Furnish and install water level controller and applicable solenoid/isolation valves and piping. Low voltage solenoid valve and level sensor relay wiring to water level controller by Pool Contractor.

q. Furnish and install all underwater pool lighting.

1) Furnish light niche and lights.

2) Install light niche and watertight conduit to a distance 5’ past exterior face of pool or vessel wall.

3) Electrical Contractor shall furnish remaining conduit and all electrical connections.

4) Following completion of electrical connections, Pool Contractor shall install lights and face rings.

r. Furnish and install all pool interior plaster and tile finishes.

1) Pools and Spas: Pool Contractor is responsible for all tile within pools and spas, up to and including handhold tile (at top of interior finished wall face). All other surrounding tile beyond pool and spa handhold is by Tile Contractor (top of raised wall, outside face of raised wall, surround, etc.).

s. Furnish and install gutter systems, including all necessary formwork, gutter grating systems, brackets, fasteners, etc.

1) Completely clean entire gutter and pool of formwork immediately following form removal.

2) Finish interior gutter surface with cement-based waterproof coating.

t. Depth and marking tiles.

1) Furnish and install all required depth and marking tile on pool walls.

2) Furnish all required depth and marking tile required for adjacent deck surface. Depth and marking tiles on adjacent deck surfaces to be installed by applicable deck finish surface contractor. Coordinate and approve depth and marker tile placement with applicable contractor prior to final installation.

3) Pool Contractor is responsible for ensuring that all depth and marking tile are installed in conformance with applicable requirements and local codes.

u. Surge tank accessories and finishes.

1) Furnish and install all accessories as indicated within the Drawings (hatch, manhole steps, etc.) for the exterior surge tank.

2) Finish surge tank interior surfaces (walls, floors, ceiling, hatch curb riser) with cement-based waterproof coating.

v. Furnish backwash pit manhole steps as indicated within the Drawings.

w. Deck accessories.

1) Furnish, layout, and install all required deck accessories and anchors.

2) Coordinate installation of anchors within adjacent deck with Concrete Contractor. Pool Contractor shall approve anchor placement locations prior to final deck installation.

3) Install and adjust all required deck accessories following completion of the pool deck.

x. Furnish and install trench drains that are cast integrally with the pool or spa structure.

1) Coordinate installation of domestic plumbing connections for trench drains with Plumbing Contractor.

y. Furnish and install all hydrotherapy jet and play feature equipment and accessories as indicated within the Drawings and Section 13 11 46, and as necessary to construct fully operating hydrotherapy and play feature systems.

1) Pumps: Furnish and install pumps including base plate and concrete equipment pad. Electrical power supply connections by Electrical Contractor.

2) Variable Frequency Drives (VFD's): Furnish and install variable frequency drives including any wall mounting hardware or unistrut support. Electrical power supply by Electrical Contractor. VFD's on feature pumps to be manually controlled (no flow sensor or control connections). Low voltage control wiring to pump by Pool Contractor.

3) Strainers: Furnish and install strainers including concrete equipment pad.

4) Flow Meters: Furnish and install flow meters as indicated on the drawings.

z. Furnish and install all safety, maintenance, and cleaning equipment as indicated within the Drawings and equipment lists.

aa. Start-up, test, and calibrate all equipment and accessories. Fill, heat, and balance pool chemicals in accordance with local jurisdictional requirements (water, heat, electricity supplied by General Contractor, chemicals supplied by Pool Contractor).

bb. When pool is turned over to Owner it shall be fully operating and in compliance with all applicable codes, regulations, etc.

cc. Protect all work, finishes, materials, equipment, etc. from damage until final acceptance by Owner. Deliver all work to the Owner clean and in working condition.

dd. Furnish all closeout documentation as required by this Section.

ee. Conduct Owner training sessions as indicated within this Section.

ff. Obtain final acceptance by all jurisdictional authorities in a timely manner preventing delays.

gg. Conduct pool system winterization and training following the first outdoor season.

hh. Conduct pool system spring startup and training prior to the second outdoor season.

ii. Miscellaneous:

1) Furnish, install and maintain proper shoring and bracing for existing utilities, sewers, and building foundations.

2) Provide all pumping/dewatering necessary to keep excavations free from water. This shall be limited to typical dewatering needs that can be accommodated through the use of a rock sump pit and standard pump within the excavation. If sand point dewatering or other extensive methods are required, this work will be coordinated with the General Contractor. Dewatering shall be performed in accordance with the Civil Drawings, including appropriate erosion control measures.

3) Furnish, erect, and maintain all necessary barricades and signs relating to their work as required to comply with applicable safety regulations.

4. Work by Others

a. Construction of backwash pit.

b. Installation of manhole steps in backwash pit.

c. Furnish and install interior drain tile sump pits and lift pumps.

d. Installation of sleeves through foundation walls, interior building walls and surge tank walls. Sleeves supplied by Pool Contractor, installed by Concrete Contractor. Pool Contractor to coordinate installation locations.

e. Installation of adjacent concrete and paver decks.

f. Installation of depth and marker tile on adjacent pool decks. Pool Contractor to coordinate location/installation with deck finish installer.

g. Install potable water supply and RPZ type backflow preventer.

h. Domestic plumbing connections to trench drains installed by Pool Contractor.

i. Vent piping at chemical feed equipment.

j. Underwater lighting electrical connections and conduit from connection point provided by Pool Contractor.

k. Line voltage (120V) conduit and electrical connections to all equipment.

l. Electrical conduit from water level sensors to the relays.

m. Furnish and install heat exchanger.

n. On-site Chlorine Generation System: Furnishing of chlorine generation system is by the General Contractor. Pool Contractor to place the skid mounted chlorine generator supplied by the General Contractor. Equipment will require some assembly and it is the responsibility of the manufacturer to install. Pool contractor to furnish and install all piping, valves, fittings, etc. to the system required for a complete installation by manufacturer.

o. Electrical bonding of pool structure, adjacent deck, equipment accessories, etc.

p. Finished tile surfaces outside of interior pool surface (deck, surrounds, etc.).

q. Pool signage in accordance with local jurisdictional requirements.

5. Permits and Fees

a. All required permits and fees are to be paid by the General Contractor and approvals will be coordinated with the General Contractor, Owner, Engineer, and Pool Contractor. Pool Contractor shall assist in the permit approval process as requested and/or required by the General Contractor, Owner, Architect, or Engineer. Pool Contractor shall supply all requested submittals and additional information requested by the permitting authority.

b. The Pool Contractor shall arrange for inspections as required and obtain required certificates of inspections. Coordinate all inspection dates and times with the General Contractor.

1.02 COORDINATION AND CLARIFICATION

A. Coordinate work with all other trades.

B. Notify the Engineer immediately of any discrepancies, ambiguities in, or omissions within the Drawings or Specifications.

1. In the case of a discrepancy, the option that is more beneficial to the Owner shall be utilized.

1.03 REQUIRED SUBMITTALS

A. Product and Manufacturer Drawings and Specifications

1. Shop drawings for all equipment in accordance with Division 1 – General Requirements.
    a. Shop drawing submittals shall include, but not be limited to the following:
        1) Structural design of all pool vessels, signed and sealed by a Professional Engineer licensed in the state of Utah.
        2) Concrete mix design, admixtures, etc.
        3) Reinforcing.
        4) Waterstops.
        5) Pool finishes (see 13 11 15).
        6) Caulking (see 13 11 15).
        7) Piping, valves, pipe sleeves, and Link Seals (see 13 11 16).
        8) All equipment as indicated within Equipment Lists for each pool (see 13 11 46).

B. Test Reports

1. Sample of the forms intended for use.
    a. Pipe pressure test report form.
    b. Water tightness test report form.
    c. Daily water chemistry log form.
2. Pipe pressure test reports utilizing accepted standard form.
3. Water tightness test reports utilizing accepted standard form.
4. Daily water chemistry logs utilizing accepted standard form. Logs shall be recorded from pool fill until turnover of operations to the Owner.

1.04 DIMENSIONAL CONFLICTS

A. All measurements shall be field verified. If any discrepancies exist between actual field measurements and measurements indicated within the drawings, the Engineer shall be informed immediately through the General Contractor. Any alteration of the plan described on the drawings due to a different field location shall be done in consultation with the General Contractor, Owner, and Engineer.

1.05 TESTS

A. Coordinate and perform all tests as required by this Specification, the Drawings, and the geotechnical report.

B. Provide all test reports to the Engineer for review and approval.

C. Testing required includes:

1. Pool piping pressure test.
    a. All piping shall prove absolutely tight under required tests. Test all completed pool piping prior to backfill.

2. Vessel water tightness test:
    a. All pools, gutters, and surge tanks shall be tested for water tightness prior to the application of finish materials.
3. Soils and material testing:
    a. Soils and material testing shall be performed by the Owner's representative and paid for by the General Contractor.
        1) Any retesting required as the result of a failed test or questionable workmanship by the Pool Contractor shall be performed by the Owner's representative at the direct expense of the Pool Contractor.
    b. The Pool Contractor is responsible for coordinating all testing schedules directly with the Owner's representative and informing the General Contractor of the scheduled tests.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and packaging with all labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle all materials in a manner to prevent damage.

D. Store all materials on clean raised platforms (with weather protective covering when stored outdoors). Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

F. Maintain storage of materials in a neat and orderly manner and store materials at locations designated by the General Contractor and in locations that will allow work by other trades to be performed without relocation of materials.

G. Provide for the storage of equipment and materials in excess of those allowed on site by the Owner's representative.

H. Pool Contractor is responsible for delivery, storage, handling, and protection of all equipment and materials until final acceptance by the Owner.

1.07 CLOSEOUT SUBMITTALS

A. Wall Charts

B. Record Drawings

C. Operation and Maintenance Manual

D. Warranty Documentation

E. Documentation of Owner Training

1.08 WALL CHARTS

A. A legible, laminated, wall-mounted color-coded piping flow diagram for all systems shall be provided in the equipment room.

B. A legible, laminated pump curve shall be provided for each pump, including the design point of the system, posted next to the specific pump.

1.09 RECORD DRAWINGS

A. Provide a complete set of record drawings for the included scope of work.

1. Record drawings shall include accurate illustrations, notations, and dimensions identifying as-built installation of piping, fixtures, equipment, etc.
    a. Minimum information shall include.
        1) Location
        2) Lengths
        3) Sizes
        4) Inverts
        5) Slopes (% and direction)
        6) All other pertinent information.
2. Indicate any differences from original plans.
3. Pool Contractor shall keep their record drawings updated daily and available for review by the General Contractor, Owner, or Engineer.
4. Underground piping record drawings shall be promptly provided to the General Contractor upon completion of all underground piping for use as a reference and coordination with the work of other trades.
5. Submit one electronic copy of record drawings in PDF, AutoCAD, or Revit format for review and approval by the General Contractor, Owner, and Engineer.
6. Provide any additional information requested during the review and perform revisions, changes, and updates to the record drawings as required.
7. Submit a complete set of final record drawings electronically in digital format utilizing AutoCAD and PDF format for records.

1.10 OPERATIONS AND MAINTENANCE MANUAL

A. Prepare detailed operations and maintenance manuals for all pool systems, equipment, and finishes.

1. The operation and maintenance manuals shall be in addition to any instructions or parts lists provided by the equipment manufacturer.
2. Operation and maintenance manuals shall include the following:
    a. For each piece of equipment:
        1) Equipment function, normal operating characteristics, and limiting conditions.
        2) Assembly, installation, alignment, adjustment, and checking instructions.
        3) Lubrication and maintenance instructions.
        4) Parts list with estimated life time of parts subject to wear.
        5) Product representatives contact name and numbers.
        6) Equipment warranty information.
    b. Valve legend table identifying valve settings for normal pool operation, backwash, and drain down operating modes.
    c. A copy of the color-coded piping flow diagram wall chart for all systems.
    d. A copy of the pump curve for each pump, including the design point of the system.

e. Operating instructions for typical pool operation modes. Operating modes shall be specifically described in outline format and in detail, referencing valve identifiers and tags. Include specific written instructions for the following operating modes and procedures.

1) Emptying and refilling the pools, including dewatering requirements during the period that the pool will be empty.

2) Filter operation and backwashing.

3) Water level control adjustment.

4) Operation, adjustment, and maintenance of chemical controllers.

5) Winterization.

6) Pool fill and startup.

7) Troubleshooting guide.

f. As-built drawings.

g. Manuals and other data shall be printed on heavy, first quality paper, 8 ½”x11” size with standard 3-hole punching. Drawings and diagrams shall be reduced to 8 ½”x11” or 11”x17”. Where reduction is not practical, larger drawings shall be folded separately and placed in envelopes bound into the manuals. Each envelope should bear suitable identification on the outside.

h. Submit one electronic copy of operations and maintenance manual in PDF format for review and approval by the General Contractor, Owner, and Engineer 4 weeks prior to final jurisdictional health inspection.

i. Provide any additional information requested during the review and perform revisions, changes, and updates to the manual(s) as required.

j. Following final approval, six (6) bound volumes of each manual shall be provided. All parts lists and information shall be assembled in substantial manuals and permanent, three-ring or three-post binders. Material shall be assembled and bound in the same order as specified, and each volume shall have a table of contents and suitable index tabs.

k. Submit a complete manual electronically in PDF format.

l. All material shall be marked with Project identification and inapplicable information shall be marked out or deleted.

m. Final operations and maintenance manuals in both written and electronic format must be received prior to final jurisdictional health inspection.

1.11 WARRANTY

A. Provide the following warranties on all work.

1. The Pool Contractor shall warranty to the Owner that all materials and equipment furnished are of good quality and new unless otherwise required or permitted by the Contract Documents.

2. The Pool Contractor shall warranty that all work, materials, and equipment will be free from defects for a period of one (1) year from the date of final acceptance by the Owner.

3. The Pool contractor shall further warranty defects in design, material, or craftsmanship relating to the water tightness of the pool vessel for a period of ten (10) years from the date of final acceptance.

4. The Pool contractor shall further warranty defects in material or craftsmanship of the pool underground piping systems for a period of two (2) years.
5. The Pool contractor shall further warranty tile, grout, adhesive, and exposed aggregate pool finish for a period of (5) years in accordance with manufacturer's warranties.
6. Provide the following additional manufacturer warranties.
    a. Filter tanks shall carry a fifteen (15) year non-pro-rated warranty.
        1) Internal piping shall carry a five (5) year non-pro-rated warranty.
        2) External face piping and valves shall carry a three (3) year non-pro-rated warranty.
    b. FRP Strainers shall carry a five (5) year warranty on the FRP shell.
    c. Any other equipment, accessories, and appurtenances that carry manufacturer warranties in excess of the required warranties provided by the Pool Contractor shall be appropriately registered by the Pool Contractor. The Pool Contractor shall supply all supplemental warranty information with their base warranty certification for the Owner's records and reference prior to final project acceptance.
7. The Pool Contractor shall agree to repair or replace any Work at no cost to the Owner upon written notification from the Owner of any defects, etc. within the warranty period.
8. A written warranty from the Pool Contractor, signed by an Officer of the company shall be provided to the General Contractor, Owner, and Engineer for review and approval prior to final project acceptance.

1.12 OWNER TRAINING

A. Provide training to the Owner's staff in the operations, maintenance, cleaning, winterization, and spring startup of the complete pool systems.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify conditions prior to start of work and notify General Contractor of any discrepancies between encountered conditions and those indicated within the Drawings and herein.

3.02 PREPARATION

A. Protect all adjacent surfaces, equipment, etc. to remain from damage during the course of work. Restore any damaged areas or equipment.

3.03 TESTING

A. Pool piping pressure test.
    1. Piping shall be pressurized with water to a minimum 35 psi for one full hour without any significant decrease in pressure.
        a. Upon test setup and initial pressurization, the Contractor shall obtain certification of the initial test conditions from the General Contractor or Owner's representative.
        b. Following completion of the required testing period, the Contractor shall obtain certification of the final test conditions from the General Contractor or Owner's representative.

c. If the pressure test fails, the Pool Contractor shall locate the failure, make the proper repairs, and retest the full pipe section at their expense.

d. A successful pressure test does not release the Pool Contractor from his warranty responsibilities and guarantees.

2. Following completion and approval of initial pressure test, the piping shall be maintained under pressure while other trades continue their work in piping areas and until the finished surface has been completed or the schedule dictates final piping connections to pumps, etc. The pressure shall be inspected and recorded weekly.

B. Vessel water tightness test.

1. Water tightness testing shall be in accordance with ACI 350.1-01, “Tightness Testing of Environmental Engineering Concrete Structures and Commentary”. The test method performed shall be the hydrostatic test with maximum allowable loss of 0.50% of the test water volume in 24 hours.

2. Testing procedure for concrete vessels.

a. Clean the exposed concrete surfaces of the vessel, including the floor, of all foreign material and debris. Mud, soil, or other foreign material may temporarily fill defects, voids, or cracks, giving test results that may not reflect the true condition of the tank. The concrete surfaces and concrete joints shall be thoroughly inspected for potential leakage points. Areas of potential leakage shall be repaired prior to filling the tank with water.

b. All openings, fittings, and pipe penetration in the vessel shell shall be inspected. Defective or cracked concrete shall be repaired.

c. All vessel penetrations and outlets shall be securely sealed to prevent the loss of water from the vessel during the test.

d. Vessel penetrations and pipe, channel, and conduit outlets shall be monitored before and during the test to determine the water tightness of these appurtenances. Leakage at these outlets shall be repaired prior to test measurements. No allowance shall be made in test measurements for uncorrected known points of leakage. The flow from the under- drain system shall be monitored during this same period and any increase in flow shall be recorded.

e. The ground water level shall be brought to a level below the top of the base slab and kept at that elevation or at a lower elevation during the test.

f. The initial filling of a new vessel shall not exceed a rate of four (4) feet per hour. Filling shall be continued until the water surface is at the design maximum liquid level.

g. The water shall be kept at the test level of the vessel for at least three days prior to the actual test for moisture absorption by the concrete and temperature stabilization of the test water.

h. The test measurements shall not be scheduled for a period when the forecast is for a substantial change in weather pattern.

i. The vertical distance to the water surface shall be measured from a fixed point on the vessel above the water surface. Measurements shall be recorded at 24 hour intervals. The water temperature shall also be recorded (at a depth of 18 in. below the water surface). The Contractor shall obtain certification of the periodic test conditions from the General Contractor or Owner’s representative.

j. The test period shall be at least the theoretical time required to lower the water surface 3/8 in. assuming a loss of water at the maximum allowable rate. The test period need not be longer than five days.

k. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned and the water level in the container recorded. If feasible, place the pail in the shallow area of the pool to maintain consistent water temperatures between the two. Mark the level of water within the pail and the pool. The Contractor shall obtain certification of the initial test conditions from the General Contractor or Owner's representative.

l. The change in water volume in the vessel shall be calculated and corrected for evaporation, precipitation, and temperature. If the loss exceeds the required criteria, the vessel shall be considered to have failed the test. The vessel shall also be considered to have failed the test if water is observed flowing or seeping from the vessel.

m. A restart of the test shall be required when test measurements become unreliable due to unusual precipitation or other external factors.

n. If the test fails, the Pool Contractor, at their expense, shall identify and correct any defects resulting in water loss. Following correction of any defects, the test shall be repeated. This process shall be continued until a passing test is obtained. All work involving repairs, corrections, and retesting (including cost of water) shall be at the sole expense of the Pool Contractor.

C. Soils and material testing.

a. Perform soils testing in accordance with the recommendations contained within the geotechnical report.

b. Perform material testing in accordance with the requirements of this Division and Division 3 – Concrete.

3.04 INSTALLATION

A. Install all equipment and materials in accordance with manufacturer's requirements and recommendations, referenced standards, and standard industry practices.

B. All work is to be installed in coordination with the construction schedule. Any additional mobilizations are the responsibility of the Pool Contractor.

C. All lap and lesson pools shall be constructed to 75'-1" in length as measured to the finish surface of the pool with a tolerance of -0" and +2". All other pool and spa dimensions shall be constructed with a tolerance of -1" and +1".

3.05 STARTUP

A. Perform system start-up. Coordinate schedule with General Contractor.

1. The Pool Contractor is responsible for start-up of all pool systems and balancing of flow rates.

a. A qualified representative of the Pool Contractor or manufacturer shall put all equipment into operation and perform all systems adjustments and calibration for proper operations.

b. Pool fill water supplied by Owner.

c. Pool Contractor shall furnish necessary chemicals to achieve water chemistry balance required by local jurisdiction for operation and within general industry standards through turnover.

1) Water balance shall consider Langlier saturation index, total alkalinity, calcium hardness, pH, free and total chlorine.

2) The Langlier saturation index shall be maintained between -0.5 and +0.5 after the pool is brought up to design operating temperature.

d. Pool Contractor shall maintain a daily log of water chemistry from system startup until turnover of operations to the Owner.

e. Pool Contractor shall maintain the operations of the systems and chemical balancing until final acceptance by Owner.

f. Following start-up, Pool Contractor shall furnish three (3) charges of perlite media for each regenerative media filter system.

B. Provide owner training.

1. A qualified representative from the Pool Contractor or manufacturer shall provide the required training on each piece of equipment.

2. Review and instruct the Owner's representative(s) on the proper operations, maintenance, and cleaning of the systems and equipment.

3. All training shall be digitally recorded. A digital copy of the training videos and sessions shall be provided to the Owner.

4. Training shall include 32 hours on site training and include the following:

a. 8 hours initial training.

b. 8 hours after Owner's staff has had 2 weeks experience operating the system.

c. 8 hours; 4 weeks after the 2nd training session.

d. Minimum 4 hours winterization training of outdoor pools.

e. Minimum 4 hours spring startup training of outdoor pools.

3.06 ADJUSTING

A. Perform all system adjustments necessary for proper operations and conformance with applicable jurisdictional requirements prior to final acceptance.

3.07 CLEANING

A. Completely clean entire gutter and pool of formwork immediately following form removal.

B. Thoroughly clean work area and all finishes, equipment, accessories, and appurtenances following completion of work and prior to final acceptance.

3.08 WINTERIZATION

A. Pool shall not remain drained during the winter or offseason.

B. Winterizing instructions for facility closure shall identify proper instructions for draining and winterizing of the pool and its systems.

C. All piping to be sloped to low point for easy winterization where feasible. If low point winterization is possible, install a 2-inch PVC ball valve at the low point with piping to waste or grade (with air gap as required). All other pipes to be blown out with compressed air for removal of all water for winterization.

D. Pool Contractor shall perform winterization and spring start-up of the outdoor pools following the first regular pool season. The Pool Contractor shall include all labor and materials costs as necessary. All materials required for winterizing (i.e. plugs, etc.) shall be furnished by the Pool Contractor and provided to the Owner for continued use following completion of the work.

E. If the project schedule includes completion and a Grand Opening event within the regular winter season, the Pool Contractor shall include an additional winterization and spring start-up to allow for operation of the outdoor pools during the Grand Opening event.

END OF SECTION

SECTION 13 11 15

SWIMMING POOL FINISHES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes pool finishes.

B. Products Furnished Under This Section

1. Ceramic tile.
2. Cementitious bonding coat.
3. Exposed aggregate pool finish.
4. Cement-based waterproof coating.
5. Gutter grating.
6. Caulking.

C. Related Documents

1. Section 09 30 00.
2. Section 13 11 13.

1.02 REFERENCES

A. Reference Standards

1. The work in this section is subject to the requirements of applicable portions of the following standards:
    a. Referenced standards in Section 09 30 00.
    b. CRD-C 506 – Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating.
    c. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
    d. ASTM C 321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
    e. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic Cement Mortars,
    f. ASTM C 596 - Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
    g. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
    h. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
    i. ASTM E903 – Standard Test Methods for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
    j. ASTM G154 – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
    k. ANSI 118.7 – High Performance Cement Grouts for Tile Installation.

l. ANSI/APSP/ICC/NPC-12 2016 – American National Standard for the Plastering of Swimming Pools and Spas.

m. COE CRD-C 48-92 - Method of Test for Water Permeability of Concrete: U.S. Army Corps of Engineers.

n. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects (for use of waterproofing material on structures holding potable water).

o. National Plasterer's Council Technical Manual – Tenth Edition.

p. Salt Lake County Health Department, Water Quality Bureau, Environmental Health Division, Health Regulation #2: Design, Construction, and Operation of Pools.

q. Utah Office of Administrative Rules, Rule 392: Health and Human Services, Population Health, Environmental Health – Rule 302: Design, Construction and Operation of Public Pools.

r. OSHA Rules and Regulations.

1.03 SUBMITTALS

A. Provide submittals in accordance with Division 1 – General Requirements.

B. Provide the following submittals.

1. Product data or submittals requested by the General Contractor, Owner, or Engineer.
2. Ceramic tile – see Section 09 30 00.
3. Cementitious bonding coat.
    a. Product information and manufacturer's installation instructions.
4. Exposed aggregate pool finish.
    a. Product information and manufacturer's installation instructions.
    b. Batch numbers of bags used (for warranty purposes).
    c. Prepare a 12" square panel at the site demonstrating color and texture for pool plaster. Finished plaster work shall match the approved sample panel.
    d. Exposed aggregate pool finish manufacturer's completed warranty form for each pool vessel. Include the list of all Batch Numbers utilized on the pool vessel.
5. Cement-based waterproof coating.
    a. Product information and manufacturer's installation instructions.
6. Grating
    a. Manufacturer's product data submittals.
    b. Two (2) samples of each material specified (including curb angle), minimum 12" length.
7. Caulking.
    a. Product information and manufacturer's installation instructions.

1.04 PERFORMANCE REQUIREMENTS

A. Ceramic tile – see Section 09 30 00.

1.05 QUALITY ASSURANCE

A. Ceramic tile – see Section 09 30 00.

B. Exposed aggregate pool finish.

1. Furnish product of company specializing in manufacture of exposed aggregate pool finishes with minimum experience of 15 years.

2. Installer must be certified by coating manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Refer to requirements in Section 13 11 13.

1.07 WARRANTY

A. Refer to requirements in Section 13 11 13.

B. Exposed aggregate finish manufacturer shall provide a five year pro-rated material warranty.

1.08 EXTRA MATERIALS

A. Ceramic tile – see Section 09 30 00.

B. Exposed aggregate pool finish.

1. Furnish one bag of each batch used in mix to Owner with description of mix ratio used and installation instructions (for Owner's use in making repairs).

1.09 MAINTENANCE

A. Ceramic tile – see Section 09 30 00.

PART 2 PRODUCTS

2.01 CERAMIC TILE

A. See Section 09 30 00.

2.02 CEMENTITIOUS BONDING COAT

A. SGM Bond Kote as manufactured by Southern Grouts and Mortars, or equal.

1. Bond coating material shall be supplied and recommended for use with exposed aggregate finish by the aggregate finish manufacturer.

2. Water: Potable water without detrimental minerals, metals, hardness, or alkalinity. If in doubt, verify quality with coating manufacturer.

2.03 EXPOSED AGGREGATE PLASTER FINISH

A. SGM Diamond Brite exposed aggregate finish as manufactured by Southern Grouts and Mortars, or equal.

1. 100% quartz aggregate.

a. Quartz aggregates must be supplied by manufacturer of coating material.

2. Polymer modified cement.

3. Color: Diamond Brite "Blue".

4. Use only pre-blended products.

5. Furnish enough material to have sufficient quantity for replacement of unsatisfactory work.

2.04 CEMENT-BASED WATERPROOF COATING

A. Basecrete cementitious compound as manufactured by Basecrete Flexible Waterproofing Technologies, or equal.

1. Blend of rapid-drying Portland cement, uniquely treated quartz sand and a compound of active proprietary chemicals with the following characteristics:

a. Color: White.

b. Aggregate: Compound / Powder.

c. Potable water: (NSF/ANSI Standard 61) Certification for potable water structures.

d. Permeability: (CRD-C 48-92) No measurable leakage through waterproofed concrete, when tested at 460 feet (140 m) head or 200 psi (14 bar), positive or negative water pressure.

B. Basecrete cementitious flexible waterproofing membrane (BC-L0145 | BC-L0617) as manufactured by Basecrete Flexible Waterproofing Technologies, or equal.

1. Blend of rapid-drying Portland cement, uniquely treated quartz sand and a compound of active proprietary chemicals with the following characteristics:

a. Compressive Strength: (ASTM C109) 6500 psi | 48.6 MPa.

b. Flexural Strength: (ASTM C-348) 2380 psi | 16.41 MPa.

c. Shrinkage: (ASTM C-596) 0.03%.

d. Adhesion/Bond: (ASTM C-321)

1) Concrete 1372 psi | 9.46 MPa.

2) Steel 1144 psi | 7.89 MPa / Bond 720 psi | 4.96 MPa.

e. Potable water: (NSF/ANSI 61) Certification for potable water structures.

C. Water: Clean cleat, non-alkaline and free of salts and other harmful elements; potable.

2.05 GRATING

A. Quietflow parallel grating as manufactured by Lawson Aquatics, Daldorado, or equal.

1. Sections of UV-stabilized PVC parallel grating, with a depth of 1.0”.

2. UV-stabilized PVC curb angle shall be supplied by grating manufacturer.

3. Components must meet ASTM G154 standards, requiring finished products to withstand 750 hours UV exposure.

4. The top surface must have a raised, non-slip pattern to meet the static coefficient of friction, while wet or dry, in accordance with ASTM C1028.

a. The top surface shall comply with federal ADA regulations.

5. The space between the pieces must not exceed 0.375” and provide a minimum of 37.5% open area per foot to allow unrestricted water flow.

6. Grating must meet or exceed ASTM E661, which states allowable deflection at 200 lbs. and load to failure criteria.

7. All grating and curb angles are to be secured with stainless steel hardware (Grade 316). All fastening hardware shall be supplied by the manufacturer.

8. Radius sections of grating must be on-site adjustable to conform to the constructed profile of the pool.
9. Color selection for outdoor pools shall be Bone.
10. Color for alternate products shall be selected from standard palette by Owner/Architect.

2.06 CAULKING

A. DECK-O-SEAL as manufactured by deck-o-seal, a division of W.R. Meadows, or equal.
1. Primer: Rezi Weld LV as manufactured by W.R. Meadows, or equal.
2. Liquid, self-leveling.
3. 24-hour cure time.
4. Product shall be recommended for use in sealing joints on swimming pool decks.
5. Product shall be acceptable for interior and exterior use.
6. Elongation: 500%+
7. Tensile Strength: 125 PSI
8. Color: Selection by Architect/Owner from standard palette.

B. DECK-O-SEAL 125 as manufactured by deck-o-seal, a division of W.R. Meadows, or equal.
1. Primer: Rezi Weld LV as manufactured by W.R. Meadows, or equal.
2. Liquid, self-leveling.
3. 24-hour cure time.
4. Product shall be recommended for use in swimming pool floor joints and submerged applications.
5. Elongation: 400%+
6. Tensile Strength: 125 PSI
7. Color: Dura-White

C. DECK-O-SEAL GUN GRADE as manufactured by deck-o-seal, a division of W.R. Meadows, or equal.
1. Primer: Rezi Weld LV as manufactured by W.R. Meadows, or equal.
2. 24-hour cure time.
3. Product shall be recommended for use in sealing joints on pool sidewall and submerged applications.
4. Elongation: 400%+
5. Tensile Strength: 125 PSI
6. Color: Dura-White

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify conditions prior to start of work and notify General Contractor of any discrepancies between encountered conditions and those indicated within the Drawings and herein.

B. Ceramic tile – see Section 09 30 00.

3.02 PREPARATION

A. Protect all adjacent surfaces, equipment, etc. to remain from damage during course of work. Restore any damaged areas or equipment.

B. Prepare all surfaces in strict accordance with the manufacturer's requirements.

C. Ceramic tile – see Section 09 30 00.

D. Cementitious bonding coat.

1. Application of bonding coat and subsequent plastering shall not be started until the pool recirculation, filtration, and chemical feed system is installed and ready for operation.
2. Do not begin installation until concrete pool shell has cured at least 28 days.
3. Prepare surface in strict accordance with manufacturer's instructions.
4. Examine pool surfaces to identify conditions that might interfere with proper bonding of coating.
5. Make surface sufficiently rough to provide a strong mechanical bond.
6. Clean pool surfaces of all material that might interfere with proper bonding of coatings.
7. Clean with high-pressure water immediately prior to bonding coat application.
8. Let pool drain until there is no standing water present.

E. Exposed aggregate pool finish.

1. Prepare surface in strict accordance with manufacturer's instructions.
2. Environmental and temperature conditions shall be in strict accordance with manufacturer's installation instructions.
3. Apply cementitious bonding coat.
4. Wait minimum 6 hours, maximum 3 days following application of bond coat prior to plastering.
5. If plaster is not applied same day as bonding coat, thoroughly wash down entire surface with "jet nozzle" hose to ensure bonding coat is clean and free of dirt, efflorescence, and other contaminants.
6. Mist bonding coat with clean cool water prior to plastering to permit proper hydration.

F. Cement-based waterproof coating.

1. Prepare surface in strict accordance with manufacturer's requirements. Follow manufacturer's instructions to clean and prepare surfaces and seal cracks and joints.
2. Remove remaining concrete fins and projections, and general surface dirt.
3. Remove grease, oil and other contaminants. Use high-pressure water blasting, wet or dry sand blasting, wire brush if applicable or other methods recommended by waterproofing manufacturer to produce surfaces suitable ("tooth and suction") for application of waterproofing, minimum ICRI CSP 3 profile. Do not apply to smooth slabs.
4. Rout out faulty construction joints and visible cracks not subject to movement, exceeding 0.02" (0.4 mm) in width to approx. 3/4" (20 mm) width and minimum 1" (25 mm) depth.
5. Remove all protrusions, work back to sound concrete and chisel out any spalled or honeycombed areas.

6. Roughen form tie holes.
7. Stop active water leakages as per manufacturer's specifications.
8. Rinse surfaces to be waterproofed several times so that the concrete is thoroughly saturated. Surfaces shall be moist but not wet when waterproofing system is applied. Remove any surface water on horizontal surfaces.

G. Grating
1. Ensure pool gutter is thoroughly cleaned and the appropriate finish has been installed prior to starting installation of grating and supports.

H. Caulking
1. Concrete should be completely cured and free from all foreign materials and contamination from curing agents. Do not begin installation until concrete pool shell has cured at least 28 days.
2. For proper adhesion, joints must be clean and dry. Remove foreign substances, incompressibles, and free water from joint opening.
3. To maintain cleanliness around the joint to be sealed, apply masking tape 2" wide to the surfaces adjoining both sides of the joint before primer or caulking are applied.
4. Control depth of sealant subject to submersion with suitable expansion joint (to support the weight joint sealant is subject to).
5. Apply primer in accordance with manufacturer's instructions.
6. Apply primer to properly prepared joint surfaces by brush, depositing a light, continuous film. Do not over-apply.
7. Primer must be tacky to the touch and not allowed to dry before applying sealant to the joint.

3.03 INSTALLATION

A. Install all products in strict conformance with manufacturer's instructions.

B. Ceramic tile – see Section 09 30 00.

C. Cementitious bonding coat.
1. Ensure proper temperatures are maintained per manufacturer's requirement during installation and curing.
2. Install bonding coat to all interior pool surfaces (walls and floors) receiving exposed aggregate finish.
3. Apply bonding coat, let material set for approximately one (1) minute, then rough up surface to desired finish with clean textured roller.
4. Ensure application is uniform in thickness and texture.

D. Exposed aggregate pool finish.
1. Ensure proper temperatures are maintained per manufacturer's requirement during installation and curing.
2. Mix coating to produce best quality and consistent color throughout. If material from more than one batch number is used, mix all batches together for color consistency.

3. Mist the shell with cool, clean potable water. Do not apply plaster to areas with standing water. Do not apply plaster to hot, dry shells.
4. Apply finish plaster to nominal ½" thickness at all locations. Apply, trowel, and expose aggregate using methods and sequence selected from manufacturer's recommended options to produce the most uniform finish.
5. Avoid practices that may cause washouts, shadows, streaks, or discoloration and repair all areas with stated characteristics.
6. Expose aggregate per manufacturer's instructions.
7. When plastering of the entire pool cannot be completed in one day, apply plaster surface up to established pool control joints or install ceramic tile joint between adjacent applications.
8. Ensure completed plastered areas remain continually hydrated via sprinklers, etc. when complete pool plastering installation cannot be completed in one (1) day.
9. Allow coating to air dry before filling pool. Avoid filling too soon causing mottling. Avoid drying out causing shrinkage cracking.
10. Fill pool completely and without interruption with clean, potable water. Start pool recirculation and filtration system once an adequate water level is present.
    a. First Day: Add sequestering agent upon initial fill per manufacturer's instructions and maintain water circulation for 24 hours prior to balancing pool chemistry.
    b. Second Day: Record pH, total alkalinity, calcium hardness and temperature levels. Adjust pH to 7.4-7.6 and total alkalinity to 80-120 PPM. Dissolve all chemicals completely in water before adding to pool, and allow sufficient time for each chemical to be fully dispersed before adding other chemicals. Do not add chlorine or calcium chloride.
    c. Third Day: Repeats steps from Second Day. Adjust chemistry to the following levels.
        1) Free Chlorine: 1.0 - 3.0 PPM
        2) pH: 7.4 - 7.6
        3) Total Alkalinity: 80 - 120 PPM
        4) Calcium Hardness: 200 - 400 PPM
        5) Stabilizer: 30 - 100 PPM
    d. Test and record water chemistry values once a week thereafter, and adjust to jurisdiction requirements and as indicated per manufacturer recommendations until final acceptance by Owner.
    e. Brush entire surface twice daily for the first three (3) days.
    f. Brush entire pool, walls and floor daily for the first two (2) weeks.
    g. Brush entire pool, walls and floor weekly thereafter and remove any debris and foreign materials immediately to prevent staining until final acceptance by Owner.
11. Replace areas of non-uniform appearance and areas with inadequate surface bond.

E. Cement-based waterproof coating.

1. Applicability: Shall be used to finish all pool gutters and interior walls and floors of all surge tanks and backwash pits.
2. Apply waterproofing material in quantities as per manufacturer's specifications and recommendations.
3. Cavity Fill:
    a. Prime cavities at cleaned and prepared faulty construction joints, cracks, form tie holes, etc. with waterproofing material and fill flush to surface with patching compound in mortar type consistency.
    b. Laminate patching compound in 2 to 3 layers as per manufacturer's instructions for larger spalled or honeycombed areas.
4. Horizontal and Vertical Construction Joints:
    a. Prime seal strips/ reglets in pre-formed 1" x 1" (25 x 25 mm) cavities with waterproofing material and fill flush to surface with patching compound (mortar consistency.)
5. Horizontal surfaces:
    a. Dry-sprinkle waterproofing material to freshly poured slabs at 2.0 lb/sq.yd. (1.0 kg/sq.m) and power or hand trowel.
    b. Dry distribute to pre-watered mud slab or existing slab to receive another topping at 2.25 lb/sq.yd. (1.2 kg/sq.m) immediately prior to casting the structural slab or new topping. Alternatively apply in slurry form. Contact manufacturer for guidance. info@basecreteusa.com P. 941-312-5142
    c. Brush or spray apply waterproofing material in slurry consistency, in one coat on existing slabs.
        1) For standard applications, apply at rate of 2.0 lb/sq.yd. (1.0 kg/sq.m).
        2) For applications in contact with salt or wastewater, apply at rate of 2.5 - 2.8 lb/sq.yd. (1.4 to 1.5 kg/sq.m).
        3) Spread material evenly and work it well into the surface.
6. Vertical Surfaces:
    a. Apply base coat of waterproofing material in slurry consistency at uniform rate of 1.25 - 1.4 lb/sq.yd. (0.7 to 0.75 kg/sq.m). Apply using appropriate compressed-air spray equipment, stiff masonry brush or stiff broom.
    b. After base coat has reached initial set but is still "green" (tacky), apply finish slurry coat of waterproofing material at 1.25 -1.4 lb/sq.yd. (0.7 to 0.75 kg/sq.m). Apply so that final brush or broom strokes leave parallel, uniform texture. Use light pre watering between coats when rapid drying conditions occur.
7. Curing:
    a. Follow manufacturer's general instructions for curing and hardening of waterproofing material.
    b. Protect surfaces from rain, frost and drying out.

F. Grating.

1. Install curb angle and grating level and true to the pool wall and adjacent deck in strict accordance with manufacturer's instructions utilizing fastener's supplied by the manufacturer.
2. All gutter grating shall be installed flush with adjacent surfaces (coping and deck) within a tolerance of 1/8".
3. Gaps between curb angle and grating at gutter to deck and gutter to coping interface shall not exceed 0.375".

G. Caulking.

1. Applicability:
   a. Utilize DECK-O-SEAL for all sealing joints at pool deck surface.
   b. Utilize DECK-O-SEAL 125 or DECK-O-SEAL GUN GRADE for all submerged horizontal pool floor joints.
   c. Utilize DECK-O-SEAL GUN GRADE for all submerged vertical pool wall joints.
2. Ensure proper temperatures are maintained per manufacturer's requirement during installation and curing.
3. Apply primer in accordance with manufacturer's instructions.
4. Mix material in accordance with manufacturer's instructions.
5. Apply thoroughly blended material with a hand- or air-operated caulking gun, putty knife, or trowel.
6. Tool sealant beads with tools wetted with clean water.
7. Remove masking tape before sealant begins to set.
8. Allow material to cure for 24 hours minimum prior to filling of pool (@ 77 degrees F, allow longer periods for colder temperatures).

3.04 CLEANING

A. Clean all adjacent surfaces as required. Ensure finished surfaces (tile, pavers, etc.) are completely clean of any debris, plaster, sealants, etc.

B. Ceramic tile – see Section 09 30 00.

3.05 PROTECTION

A. Ceramic tile – see Section 09 30 00.

B. Exposed aggregate pool finish.

1. Provide minimum cure time of 28 days prior to draining pool.
2. Do not operate automatic pool cleaners for 28 days. Do not vacuum the pool with a wheeled vacuum for 14 days.

C. Grating.

1. Protect finished grating surface from damage resulting from construction.
   a. If significant construction foot traffic is expected on the finished gutter, cover appropriately for protection.
   b. Promptly clean and remove all debris and dirt, etc. to protect from staining.

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END OF SECTION

SECTION 13 11 16
SWIMMING POOL PIPING & VALVES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes pool piping, valves, insulation, hardware, and accessories.

B. Products Furnished Under This Section

1. PVC Schedule 40 piping & valves.
2. PVC Schedule 80 piping & valves.
3. CPVC Schedule 40 piping & valves.
4. Pipe insulation.
5. Y-strainers.
6. Hardware, supports, and hangers.
7. Pipe penetration seals and sleeves.

C. Related Documents

1. Section 13 11 13.

1.02 REFERENCES

A. Reference Standards

1. The work in this section is subject to the requirements of applicable portions of the following standards:
   a. ASTM C195 – Standard Specification for Mineral Fiber Thermal Insulating Cement.
   b. ASTM C449 – Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   c. ASTM C534 – Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   d. ASTM C547 – Standard Specification for Mineral Fiber Insulation.
   e. ASTM C547-19 – Standard Specifications for Mineral Fiber Pipe Insulation.
   f. ASTM C 553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   g. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   h. ASTM C921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   i. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   j. ASTM C 1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Duct.
   k. ASTM C1393 – Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.
   l. ASTM C1696-20 – Standard Guide for Industrial Thermal Insulation Systems.
   m. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

n. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

o. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings – Schedule 80.

p. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings – Schedule 40.

q. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings – Schedule 80.

r. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe & Fittings.

s. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

t. ASTM D2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

u. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

v. ASTM F441 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

w. ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe & Fittings.

x. ASTM F656 – Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

y. ASTM F2618 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems.

z. CSA B137.3-99 – Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

aa. 2021 International Building Code.

bb. Salt Lake County Health Department, Water Quality Bureau, Environmental Health Division, Health Regulation #2: Design, Construction, and Operation of Pools.

cc. Utah Office of Administrative Rules, Rule 392: Health and Human Services, Population Health, Environmental Health – Rule 302: Design, Construction and Operation of Public Pools.

dd. Virginia Graeme Baker Pool and Spa Safety Act (VGBA ANSI/APSP/ICC-16 2017).

ee. OSHA Rules and Regulations.

1.03 SUBMITTALS

A. Provide submittals in accordance with Division 1 – General Requirements.

B. Provide the following submittals.

1. PVC & CPVC pipe materials and valve product data sheets.
2. Pipe insulation product data sheets.
3. In-line modulating float valve product data sheets.

4. Y-Strainer product data sheets.
5. Pipe support hardware material data sheets.
6. Pipe penetration seals and sleeves product data sheets.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Refer to requirements in Section 13 11 13.

1.05 WARRANTY

A. Refer to requirements in Section 13 11 13.

PART 2 PRODUCTS

2.01 GRANULAR BEDDING MATERIAL

A. Provide free-draining granular materials for bedding and backfill of all pipe trenches.

1. Granular bedding material shall be a graded aggregate product of which 100 percent will pass the 25.0 mm (1 inch) sieve and not more than 10 percent will pass the 75um (#200) sieve.

2.02 PIPING & FITTINGS

A. PVC Schedule 40

1. All PVC Schedule 40 white pipe and fittings shall be produced from PVC Type I cell classification 12454, conforming to ASTM D1784 by Spears Manufacturing Company, or equal.
    a. All injection molded PVC Schedule 40 white fittings shall be certified for potable water service by NSF International and manufactured in strict compliance to ASTM D2466.
    b. Fabricated fittings are allowed for pipe sizes 10” and larger only. All fabricated fittings shall be produced in accordance with Spears General Specifications for Fabricated Fittings.
    c. All PVC flanges shall be designed and manufactured to meet CL150 bolt pattern per ANSI Standard B16.5 and rated for a maximum internal pressure of 150 psi, non-shock at 73°F.

B. PVC Schedule 80

1. All PVC Schedule 80 pipe and fittings shall be produced from PVC Type I, cell classification 12454, conforming to ASTM Standard D1784 by Spears Manufacturing Company, or equal.
    a. All injection molded PVC Schedule 80 fittings shall be certified for potable water service by NSF International and manufactured in strict compliance to ASTM D2467.
    b. Fabricated fittings are allowed for pipe sizes 10” and larger only. All fabricated fittings shall be produced in accordance with Spears General Specifications for Fabricated Fittings.
    c. All PVC flanges shall be designed and manufactured to meet CL150 bolt pattern per ANSI Standard B16.5 and rated for a maximum internal pressure of 150 psi, non-shock at 73°F.

C. CPVC Schedule 40

1. All CPVC Schedule 40 pipe and fittings shall be produced from CPVC materials, cell classification 23447 conforming to ASTM Standard D1784 by Spears Manufacturing Company, or equal.

   a. All injection-molded fittings through 12” shall be manufactured in compliance to ASTM F439 and Certified by NSF International for use with potable water service.

   b. Fabricated fittings are allowed for pipe sizes 10” and larger only. All fabricated fittings shall be produced in accordance with Spears General Specifications for Fabricated Fittings.

   c. All CPVC flanges shall be designed and manufactured to meet CL150 bolt pattern per ANSI Standard B16.5.

D. Solvent Cement & Primer

1. The primer & cement used for connecting PVC piping & fittings shall be clear in color at all locations where the pipe is visible. The cement used for connecting CPVC piping and fittings shall be gray in color at all locations where the pipe is visible.

   a. Primer as manufactured by Spears Manufacturing Company, Primer-68 (clear), or equal.

   b. Solvent for PVC Schedule 40 & 80 as manufactured by Spears Manufacturing Company, PVC- 17 (clear), or equal.

   c. Solvent for CPVC Schedule 40 as manufactured by Spears Manufacturing Company, CPVC- 24 (gray), or equal.

2.03 VALVES

A. All valve bodies and components shall be non-metallic or stainless steel unless otherwise specified.

B. All valves two- and one-half inches (2-1/2”) and smaller in size shall be thermoplastic ball valves, True Union 2000 Industrial type as manufactured by Spears Manufacturing Company, or equal.

1. Valves shall be manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447.

2. All o-rings shall be EPDM.

3. All valves shall have Safe-T-Shear stem with double o-ring stem seals.

4. All valve handles shall be polypropylene with built-in lockout mechanism.

5. All valve union nuts shall have Buttress threads.

6. All seal carriers shall be Safe-T-Blocked.

7. All valve components shall be replaceable.

8. All valves shall be certified by NSF International for use in potable water service.

9. All 1/2" through 2" valves shall be pressure rated to 170 psi, all 2-1/2" valves shall be pressure rated to 150 psi for water at 73° F.

C. All valves three inches (3”) and larger in size shall be thermoplastic butterfly valves as manufactured by Spears Manufacturing Company, or equal.

1. Valves shall be constructed from PVC Type I Cell Classification 12454 or CPVC Type IV Cell Classification 23447.

2. Valves 3”-6” in size shall be wafer butterfly style. Valves 8” and greater in size shall be standard butterfly style.
3. Valves 3”-8” shall be provided with lever operators.
    a. Lever operated valves shall be equipped with high impact polypropylene handle having built-in lockout capability and seven (7) position stops.
4. Valves 10” and larger shall be provided with gear operators.
    a. Gear operated valves shall be equipped with position indicator and a high impact polypropylene hand wheel.
5. All valve seats and o-rings shall be Buna-N, EPDM.
6. Seat shall be a non-liner type interlocked to valve body.
7. Bolt hole patterns shall conform to ANSI/ASME B16.5 Class 150.
8. Disc shall be offset design with fully isolated Type 316L stainless steel stem and Type 316 stainless steel hardware.
9. Valves shall be pressure rated at 150 psi for water at 73° F.

D. Check valves.
1. All check valves shall be constructed of non-metallic components, shall provide quick response shut-off in any position, and shall be suitable for horizontal or vertical installation.
2. All check valves three inches (3”) and smaller in size shall be thermoplastic True Union 2000 Industrial Ball Check type as manufactured by Spears Manufacturing Company, or equal.
    a. Check valve shall be manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D1784, Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447.
    b. All o-rings shall be EPDM.
    c. All valve union nuts shall have Buttress threads.
    d. All valve seats shall be a standard o-ring type.
    e. All seal carriers shall be Safe-T-Blocked.
    f. All valve components shall be replaceable.
    g. All valves shall be certified by NSF International for use in potable water service.
    h. All PVC and CPVC 1/2" through 2" valves shall be pressure rated to 235 psi, all 2-1/2" and 3” valves shall be pressure rated to 150 psi, for water at 73°F.
3. All check valves four inches (4”) and larger in size shall be thermoplastic butterfly type as manufactured by Spears Manufacturing Company, or equal.
    a. Valve shall be constructed from PVC Type I, ASTM D1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell classification 23447.
    b. Valves shall be flanged.
    c. All valve seals shall be reinforced EPDM and field replaceable.
    d. All 4" through 8" valves shall be pressure rated at 150 psi, all 10" and 12" valves at 100 psi, for water at 73° F.

E. In-line modulating float valve.

1. Modulating float valves shall be of a non-corrosive, in-line mounted design as manufactured by Neptune-Benson Corporation, Mer-Made, or equal.
    a. The in-line modulating float valve shall be an imbalanced butterfly valve design.
        1) The internal valve disc of the modulating float valve shall be an imbalanced wafer type design to allow for pressure assisted opening from the pool water column.
    b. The valve shall be operated through the open and closed position with 7” stainless steel floats attached to the float arms.
    c. The valve shall be fully open with the floats down and 5% open with the floats in the up position.
        1) Modulating float valves that are not of an imbalanced butterfly design to prevent sticking of the valve in the closed position and/or have more than a 5% open area in the closed position will not be approved as equals.
    d. The in-line modulating float valve shall be installed between two companion flanges and shall have dual float arm positions that facilitate both horizontal and vertical in-line configurations.
    e. The valve shall be constructed of Schedule 80 PVC pipe with Schedule 80 PVC flanges, 304 stainless steel wafer type disc, stainless steel valve body shaft, stainless steel linkage/stop pins and 7” stainless steel floats.
        1) The valve disc shall be designed for reliable main drain flow rate adjustment through the full operational range of the float valve and shall prevent sticking in the closed position.
        2) The valve body shaft and linkage shall be machined from 304 stainless steel.
        3) The modulating float valve shall be provided with 316 stainless steel stop pins seated in the clevis and valve body flange to provide position stops for both the open and closed positions.
        4) The floats shall be constructed of 304 stainless steel.

2.04 PIPE INSULATION

A. 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 Pipe Insulation.
    d. ArmaCell; AP ArmaFlex.
    e. Owens Corning; Fiberglas.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified below. Nominal density is 4 lb/cu. ft. or more.
3. Molded closed cell polyethylene foam insulation is not an approved equal.

B. Insulation system shall include factory-applied jackets (ASJ) complying with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

C. ASJ tapes shall comply with the following:

1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
        2) Compac Corp.; 104 and 105.
        3) Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
        4) Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
    b. Width: 3 inches.
    c. Thickness: 11.5 mils.
    d. Adhesion: 90 ounces force/inch in width.
    e. Elongation: 2 percent.
    f. Tensile Strength: 40 lbf/inch in width.
    g. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

D. Adhesive materials shall be compatible with insulation materials, jackets, and substrates for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated. Mineral-fiber adhesive shall comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Flashing Sealants.

1. Products: Subject to compliance with requirements, provide the following:
    a. Childers Products, Division of ITW; 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, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Insulation securements shall be aluminum bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.

b. PABCO Metals Corporation; Bands.

c. RPR Products, Inc.; Bands.

G. Surface-burning characteristics for insulation and other related material shall comply with ASTM E84.

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.

2.05 Y-STRAINERS

A. Y-strainers shall be true union design with transparent PVC strainer body as manufactured by Asahi America, or equal. All O-rings shall be EPDM or FKM. Include optional clean out valve for 2" Y-strainers. Screen shall be 20 mesh PVC. Provide spare screen with each strainer.

2.06 HARDWARE

A. All fastening hardware shall be stainless steel or zinc plated steel.

2.07 SUPPORTS AND HANGERS

A. All supports, hangers, mounting equipment, anchors, etc. shall be constructed of non-corrosive materials (galvanized, stainless steel, FRP, etc.).

B. Supports and hangers can be clamp, saddle angle, spring, or other standard type.

2.08 PIPE PENETRATION SEALS AND SLEEVES

A. Modular pipe seals.

1. Modular pipe seals shall be Link-Seal modular seals manufactured by Garlock Sealing Technologies, or equal.

2. Model S-316.

a. Seal element: Black EPDM conforming to ASTM D2000 M3 BA510.

b. Pressure plates: Reinforced nylon polymer.

c. Bolts & nuts: 316 stainless steel.

d. Temperature range: -40 to 250 degrees F.

3. The seals shall be modular, mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

4. The elastomeric element must be sized and selected per manufacturer's sizing procedure.

5. Coloration shall be throughout the elastomeric element for positive field inspection.

6. Each link must have a permanent identification of the size and manufacturer's name molded into it.

B. Pipe penetration sleeves.

1. Pipe penetration sleeves shall be Century-Line engineered pipe sleeves manufactured by Garlock Sealing Technologies, or equal.

2. Sleeve assembly.
    a. Sleeve material: Molded non-metallic high-density polyethylene.
    b. Waterstop: Integrally formed hollow water stop sized having a minimum of 4 inches larger than the outside diameter of the sleeve itself and allowing ½" movement between wall forms to resist pour forces.
    c. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself.
3. Schedule 40 PVC pipe sleeves with solvent-welded PVC flange waterstops are an acceptable alternative to Century-Line sleeves.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify conditions prior to start of work and notify General Contractor of any discrepancies between encountered conditions and those indicated within the Drawings and herein.

3.02 PREPARATION

A. Protect all adjacent surfaces, equipment, etc. to remain from damage during course of work. Restore any damaged areas or equipment.

B. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 INSTALLATION

A. Pipe trench excavation.
    1. The Pool Contractor shall provide all trenching and backfill necessary for installation of underground pool piping.
    2. Pipe subgrade stabilization (as required) and backfill shall be performed in conformance with the requirements of the geotechnical report.
    3. Trench excavations shall conform to all OSHA requirements.
    4. Pool Contractor shall provide dewatering in accordance with Section 13 11 13 as required. Dewatering shall be performed in accordance with the Civil Drawings, including all necessary erosion/sedimentation control measures.
    5. Piping shall not be laid in standing water. If standing water is present, the trench shall be over- excavated and filled with a bedding layer of pea gravel and/or dewatered.
    6. Provide granular bedding materials for all underground piping. Minimum bedding depth of 4" below bottom of pipe & fittings.
    7. Backfill all piping with granular bedding materials and compact per the requirements of the geotechnical report. Provide minimum cover of 1" on the sides and 4" above top of pipe & fittings.

B. Pipe & fittings.
    1. Material & class applicability.
        a. All piping, fittings, & valves within the recirculation system carrying water with temperatures less than 110 degrees Fahrenheit shall be PVC Schedule 40.

b. All piping, fittings, & valves within the recirculation system carrying water with temperatures from 110 to 140 degrees Fahrenheit shall be CPVC Schedule 40.

c. All piping, fittings, & valves within the recirculation system carrying water with temperatures 140 degrees Fahrenheit and greater shall be copper.

d. All piping, fittings, & valves within the pool accessory systems (play feature, agitation, etc.) that are located underground or indoors shall be PVC Schedule 40.

e. All piping, fittings, & valves within the pool accessory systems (play feature, agitation, etc.) that are located aboveground outdoors shall be PVC Schedule 80. Connections to Schedule 40 piping or fittings shall be made below ground.

2. Equipment & valve connections.

a. All piping connections to equipment two and one-half (2 ½) inches and smaller in size shall be threaded connections, unless explicitly indicated within the Drawings.

b. All piping connections to valves (true union) two and one-half (2 ½) inches and smaller in size shall be solvent welded, unless explicitly indicated within the Drawings.

c. All piping connections to equipment and valves three (3) inches and larger in size shall be flanged connections, unless explicitly indicated within the Drawings.

3. Pipe & fittings shall be installed in accordance with the manufacturer's recommended instructions and the most recent ASTM Standard for installation applicable to the piping material and class.

a. Spears "Plastic Pipe Handbook".

b. PVC Schedule 40 & 80 – ASTM D1784 & ASTM D1785.

c. CPVC Schedule 40 – ASTM D1784 & ASTM F441.

4. Piping must be labeled in accordance with the requirements in Section 13 11 13 and all jurisdictional requirements.

a. Mark direction of flow.

b. Mark pool and applicable system.

c. Mark each length of pipe between fittings. For pipe lengths longer than 15' linear length, provide markings at 10' intervals.

d. All exposed piping shall be painted and color-coded in accordance with Utah Office of Administrative Rules, Rule 392: Health and Human Services, Population Health, Environmental Health – Rule 302: Design, Construction and Operation of Public Pools.

5. All pipe crossings underground shall be separated by a minimum clear distance of 4". The separation shall be filled with compacted granular bedding materials, which shall be placed and compacted prior to placement and installation of the overlying crossing pipe.

6. Install tees to accept thermowells and sensors in each heat exchanger bypass piping.

a. Two (2) Pool each, three (3) Warm Spa each, two (2) Cold Spa each. Coordinate required adapter size for sensor with Division 25.

C. Pipe Insulation

1. All piping within plenum spaces, as indicated in the Drawings, must be insulated according to local requirements and have surface burning characteristics complying with ASTM E84.

2. All pool fill piping must be insulated. *(include if: over finished space)*
3. All cold spa piping that is not buried must be insulated.
4. General insulation installation requirements.
    a. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
    b. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified.
    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 2 inches o.c.

4) Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5) Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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.

5. General insulation installation requirements on fittings, valves, strainers, flanges, unions, and instrumentation.

a. Zeston plenum rated covers over 1 pound density microlite blanket and 18 gauge galvanized wire at all fittings.

b. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

c. 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.

d. 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.

e. 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.

f. 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.

g. 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.

h. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

i. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

j. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.

6. Mineral-fiber insulation installation requirements.

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 but 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.

7. Insulation installation requirements at penetrations.
    a. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
    b. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. 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 Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.
8. Piping insulation schedule.
    a. Insulation thickness must match values below at minimum and be increased to code required values if different than that stated.
        1) Cold water process piping (1-1/2” diameter and larger): Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1 inch thick.
        2) Warm water process piping (1-1/2” diameter and larger): Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1-1/2 inch thick.

D. Valves.
1. To the greatest extent possible, valves shall be installed at convenient locations for service and operation. The operating handle or wheel shall also be installed in the most convenient configuration available for service and operation.
2. All valves shall be tagged with unique tag colors for each system and unique identification. Valves shall be identified by their tag color and number within the operations and maintenance manual and any piping flow diagrams.

E. Y-Strainers.
1. Install Y-strainers per manufacturer’s recommendations.
2. Y-Strainers to be installed in a horizontal pipe.

F. Supports & hangers.
1. Supports shall be provided at appropriate spacing intervals in accordance with manufacturer’s recommendations.
    a. Support location and spacing depends on the pipe diameter, system operating temperature, and the location of any concentrated stress loads (valves, flanges, system components, etc.).
    b. Contractor is responsible for ensuring that adequate supports are provided.
    c. Contractor shall verify load capacity of walls, structural members, ceilings, etc. utilized for anchoring of supports and hangers with the General Contractor or Engineer prior to installation.
2. Overhead piping and supports must be installed to provide a minimum clearance of seven and one- half (7 ½) feet above the finished floor surface in all accessible areas.
3. Hangers must have an adequate load-bearing surface free of any rough or sharp edges that could damage the pipe during use.

4. Hangers must not restrict linear movement of the system in order to allow thermal expansion and contraction from temperature changes.
5. Field cut ends of all galvanized or zinc coated pipe support material shall be treated with a spray-on cold galvanizing compound.
6. Stainless steel or FRP supports and hardware must be used inside of all surge tanks and other wetted areas.

G. Pipe penetration seals and sleeves.

1. Link-Seals and Century-Line sleeves shall be used at all piping penetrations in foundation walls, interior building walls, and surge tanks (for piping penetrations that are not pre-established and will not be installed prior to concrete wall construction).
2. For conditions where piping can be installed prior to installation of the concrete wall, one of the following shall be utilized:
    a. Non-swelling SF302 Synko-Flex, or equal.
    b. Solvent welded PVC flange type waterstop.
3. Provide sleeves in accordance with manufacturer’s recommended sizing (to be installed during concrete wall construction).
4. Select appropriate Link-Seal size per manufacturer’s recommendations.
5. Follow manufacturer’s installation instructions.

END OF SECTION

SECTION 13 11 46
SWIMMING POOL EQUIPMENT & ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes equipment and accessories for pools.

B. Products furnished under this section:

1. Deck equipment.
2. Health, life, and safety equipment.
3. Pool process fittings.
4. Pool process equipment.
5. Pool competition equipment.
6. Pool accessory features and equipment.
7. Surge tank equipment.
8. Maintenance and cleaning equipment.
9. ADA accessibility equipment.

C. Related Documents

1. Section 13 11 13.

1.02 REFERENCES

A. Reference Standards

1. The work in this section is subject to the requirements of applicable portions of the following standards:
    a. National Sanitation Foundation (NSF) International Standard 50 – Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs.
    b. Hydraulic Institute Standards.
    c. IEEE Standards.
    d. NEMA Standards.
    e. Underwriters Laboratories (UL).
    f. National Fire Protection Association (NFPA) 70 – National Electric Code.
    g. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
    h. ASTM G154 – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
    i. 2021 International Building Code.
    j. Salt Lake County Health Department, Water Quality Bureau, Environmental Health Division, Health Regulation #2: Design, Construction, and Operation of Pools.
    k. Utah Office of Administrative Rules, Rule 392: Health and Human Services, Population Health, Environmental Health – Rule 302: Design, Construction and Operation of Public Pools.

l. 2010 ADA Standards for Accessible Design.

m. Virginia Graeme Baker Pool and Spa Safety Act (VGBA ANSI/APSP/ICC-16 2017).

n. OSHA Rules and Regulations.

1.03 SUBMITTALS

A. Submit manufacturer's product data, certification data, and installation instructions for all items within the pool equipment lists.

1. Organize submittals into sections, one for each water body and one for general equipment.

a. The equipment for each water body (or section) shall be numbered and organized in identical order to the equipment lists contained within the Drawings.

2. Pump Curve Submittal

a. The manufacturer pump curve shall be included with each submittal indicating the pump design operating point.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Horizontal Close Coupled End Suction Centrifugal Pumps

a. To assure a properly integrated and compatible system, all equipment shall be furnished by the pump manufacturer, who shall assume full responsibility for the proper operation of the pumps and associated equipment.

2. High-Rate Sand Filters

a. The equipment described herein shall be supplied by a manufacturer regularly engaged in the fabrication of commercial aquatic pressure vessel filtration systems for at least fifteen (15) years.

b. All equipment described herein shall be supplied by the same manufacturer to ensure that each item is properly sized to perform in conjunction with each other.

c. The installer of the equipment described herein shall have a minimum (5) years of operating history working on similar commercial aquatic projects.

3. Regenerative Media Filters

a. The equipment described herein shall be products of a manufacturer regularly engaged in the fabrication of filtration and recirculation systems for at least five (5) years.

b. All equipment described herein shall be supplied by the same manufacturer to ensure that each item is properly sized to perform in conjunction with each other.

c. The installer of the equipment described herein shall have a minimum of five (5) years of operating history working on similar commercial aquatic projects.

d. Provide a manufacturer's representative who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the materials and methods specified, and who shall direct all Work performed under this Section.

e. As assurance that each item of apparatus is properly sized to perform in conjunction with each other, all components of the regenerative media filtration system shall be supplied by a filter manufacturer as listed and described herewith. Acceptable regenerative media equipment suppliers are:

Neptune-Benson | 334 Knight Street Suite 3100 Warwick, RI 02886 USA
+1 (800) 832-8002 | +1 (401) 821-2200 | www.evoqua.com

Aqua Revival | 4520 County Road F, Delavan, WI 53115
Mail: PO Box 796, Williams Bay, WI 53191
+1 (262) 725-6081 | www.aqua-revival.com

B. All equipment within the recirculation and accessory systems shall be certified to NSF Standard 50 (as applicable).

1. Documentation shall be submitted as requested.
2. Filters shall bear a label complete with NSF certification number.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Refer to requirements in Section 13 11 13.

1.06 WARRANTY

A. Refer to requirements in Section 13 11 13.

PART 2 PRODUCTS

2.01 EQUIPMENT LISTS

A. Supply and install all equipment as indicated within the equipment lists contained within the Drawings. Equipment indicated may not be inclusive of all equipment required. Pool Contractor is responsible for providing all equipment that is required for construction of a fully operational pool with accessories as indicated within the manufacturer's literature and the Project Documents. If an item of equipment is required for operation of the pools, that item shall be deemed to be included.

B. Product manufacturers and model numbers for equipment are listed to set a level of quality for each item specified. Substitutions may be allowed at the discretion of the Engineer in consultation with the Owner. The Engineer shall be the sole judge of whether equipment submitted meets or exceeds specified equipment. Requests for substitution shall be submitted in accordance with the requirements of Division 01 33 00.

1. If using alternate manufacturers, it is the responsibility of the Contractor to meet or exceed the specified equipment and make all modifications required to accommodate the substituted item.

2.02 DECK EQUIPMENT

A. Handrails

1. All handrails shall be three (3) bend stair rails as manufactured by S.R. Smith, Spectrum Products, or equal.
   a. Handrails shall be fabricated of 1.50" O.D. x 0.120" wall thickness, 304 stainless steel.
   b. Handrails bends shall be wrinkle free.
   c. Handrails shall have a baked powder coat finish that includes a primer, base coat, and clear coat finish. The powder coat system shall have a minimum total thickness of 5 mil over the entire exterior surface of the rail. Color to be similar to brushed stainless steel, equal to S.R. Smith "Silver Gray" RAL7038.

d. Handrails shall be manufactured to conform to setbacks, lengths, and stair slopes as indicated within the Drawings.

e. Handrails shall comply with the 2010 ADA Standards for Accessible Design.

B. Grab rails

1. All grab rails shall be Pretzel style as manufactured by S.R. Smith, Spectrum Products, or equal.

a. The grab rail setback shall be as indicated within the Drawings.

b. The grab rail shall be fabricated of 1.50” O.D. x 0.0.65” wall thickness, 304 stainless steel.

c. Grab rails shall be manufactured to dimensions as indicated within the Drawings.

d. The grab rail shall have bends that are wrinkle free.

e. The grab rail shall be supported by four (4) anchors.

f. Grab rails shall have a baked powder coat finish that includes a primer, base coat, and clear coat finish. The powder coat system shall have a minimum total thickness of 5 mil over the entire exterior surface of the rail. Color to be similar to brushed stainless steel, equal to S.R. Smith “Silver Gray” RAL7038.

C. Recessed Molded Steps

1. Recessed molded steps as manufactured by S.R. Smith, Spectrum Products, or equal.

a. Steps shall be manufactured from heavy-duty injection molded plastic.

b. Steps shall be manufactured to dimensions as indicated within the Drawings.

c. Steps shall include a non-skid surface on the tread.

d. Step treads shall be sloped to drain towards the pool.

e. Color: White.

D. Anchors

1. All rails shall be anchored with 1.50” stainless steel wedge anchors as manufactured by S.R. Smith,Spectrum Aquatics, or equal.

a. The anchor shall be of the wedge type and shall be designed to support a 1.50” O.D. stainless steel rail. A wedge shoe shall be employed, applying pressure to the retained rail and providing support. Wedge anchor bodies incorporating brass or bronze material will not be allowed.

b. The anchor body shall be fabricated from 316 stainless steel. The body component of the anchor shall be cast, ensuring consistent strength, ductility, and resistance to impact and it shall incorporate provisions for anti-rotation. The anchor body shall be 6” deep and shall be 1.50” inside diameter, ± 0.02”. Close tolerance dimensions shall ensure a secure fit for railings.

c. A cast brass (85-5-5-5) wedge shall be employed as the rail retainer. The wedge shall incorporate an 18-8-stainless steel 5/16-18-hexhead tightening bolt and flat washer. The wedge shall be designed as the sacrificial element to the anchor system, allowing for ease of repair and maintenance.

d. A bonding screw shall be installed on the lower portion of the anchor. The bonding screw will be 18-8-stainless steel and shall be not less than ¼" in diameter. The anchor shall be designed so that an escutcheon plate is not necessary.

e. Each anchor assembly shall include a round escutcheon plate matching the rail size. Escutcheon plates to be powder coated to match the rail finish.

E. Finish

1. All stainless-steel rails and escutcheon plates shall have a baked powder coat finish that includes a primer, base coat, and clear coat finish. The powder coat system shall have a minimum total thickness of 5 mil over the entire exterior surface of the rail. Color to be similar to brushed stainless steel, equal to S.R. Smith "Silver Gray" RAL7038.

F. Trench Drains

1. All trench drains shall be linear modular trench drain systems model Z880 manufactured by Zurn Industries LLC, or equal.

a. Drain body material: High-density polyethylene that is UV-10 stabilized.

b. Module size: Segments that are 48" long, 2 ½" wide, and 3" deep.

c. Drains shall have bedding feet to be used for positioning and anchoring purposes.

d. Drains shall have tongue and groove snap fit connections.

e. Drains shall include outlet adapters as necessary for connection to plumbing drains.

f. Drains shall include 24" long high-density polyethylene decorative grates.

g. Grate color selection: Gray.

2.03 HEALTH, LIFE, AND SAFETY EQUIPMENT

A. First aid equipment.

1. Supply the following equipment:

a. Rescue blanket shall be a wool blanket, minimum dimensions of 60" x 84", Item #10-606 as supplied by Kemp USA, or equal.

b. Rescue backboard, 78"x20", item CJ6, by C.J. Aquatics. Backboard shall include head immobilizer and straps.

1) The rescue backboard specified is prototypical for all new facilities constructed by the Owner. Substitutions will not be considered.

2. Pool Contractor shall verify that all equipment is in compliance with applicable jurisdictional requirements, that sufficient quantities are present, and that no other equipment is required for final jurisdictional approval. The Engineer shall be notified if additional quantities or equipment are required.

B. Signage

1. Pool signage to be procured and installed by Owner.

C. Rope Anchors

1. All rope anchors shall be constructed of a non-metallic body with a stainless steel bar as manufactured by Pentair Water Pool and Spa, or equal.

a. The size of the stainless-steel bar within the anchor shall be less than maximum size requirements per NEC for exclusion of required grounding.

b. The cup and flange portion of the anchor body shall be stamped or drawn from a single piece of material.

c. The cup portion shall be 3” inside diameter with a depth of 2.5”.

d. The face flange shall be 4” square.

D. Stanchion posts.

1. All stanchion posts shall be stainless steel with an integral eye ring as manufactured by S.R. Smith, Spectrum Products, or equal.

a. 8’-0” length

1) The stanchion post shall be fabricated of 1.90” O.D. x 0.145” wall thickness 304 series stainless steel.

2) The post shall be 96” in overall length.

3) Posts shall have a baked powder coat finish that includes a primer, base coat, and clear coat finish. The powder coat system shall have a minimum total thickness of 5 mil over the entire exterior surface of the post. Color to be similar to brushed stainless steel, equal to S.R. Smith “Silver Gray” RAL7038.

b. All stanchion posts shall have a 2” ring MIG welded to their top surface.

c. All stanchion posts shall be supported by one (1) 6” 316 stainless steel slip-type anchor as manufactured by S.R. Smith, or equal.

1) The anchor shall be supplied by the same manufacturer as the stanchion post.

2) The anchor shall come complete with a slip style stainless steel lid.

E. Lifeline rope and floats.

1. Rope shall be ¾” diameter pool rope.

a. Rope shall be recommended for use in pools.

b. Rope shall be made from a color-safe, strong, floating polypropylene.

c. Supply chrome plated brass clamp-type rope hooks for all connections to cup anchors at pool wall.

d. Color shall be blue and white.

2. Floats shall be Handi-Lock, 5-inch x 9 inch, or equal.

a. Floats shall be recommended for use in pool.

b. Floats shall be made of linear polyethylene treated with chlorine inhibitors and UV stabilizers.

c. Floats shall be capable of locking onto the lifeline rope without attachments.

d. Floats shall have three sealed compartments for optimum buoyancy in case of puncture.

e. Color shall be blue and white.

F. Life hooks.

1. Life hook shall be “shepherd’s crook” style with fixed sixteen (16) foot pole as manufactured by Pentair, or equal.

a. Pole shall be constructed of fiberglass, aluminum, or stainless steel.

b. Life hook shape and dimensions shall be typical of standard industry designs.

c. Each life hook shall be supplied with two (2) stainless steel pole hangers as supplied by Pentair, or equal.

1) Mounting hardware shall be supplied by manufacturer.

d. Pool Contractor shall ensure that life hook supplied meets all jurisdictional requirements and is of sufficient quantity. Notify the Engineer if additional quantities or alternate equipment is required.

G. Ring buoys.

1. Ring buoys shall be twenty-four (24) inch diameter, United States Coast Guard approved, as supplied by Cal June, or equal.

a. Ring buoy shall be supplied complete with a minimum 3/16" diameter throw rope (length per individual vessel Equipment List in Drawings).

b. Throw rope.

1) Rope shall be recommended for use in pool.

2) Rope shall be made from a color-safe, strong, floating polypropylene.

3) Throw rope shall be coiled or bagged to preclude tangling during use.

c. Each ring buoy shall be supplied with one (1) stainless steel pole hanger as supplied by Pentair, or equal.

1) Mounting hardware shall be supplied by manufacturer.

d. Pool Contractor shall ensure that ring buoy supplied meets all jurisdictional requirements and is of sufficient quantity. Notify the Engineer if additional quantities or alternate equipment is required.

H. Lifeguard chairs.

1. Lifeguard chairs as manufactured by Tailwind Furniture.

a. Chairs and frames shall be constructed of recycled plastic with UV inhibitors and stainless steel hardware.

b. Chair steps shall have a non-skid surface.

c. Chairs shall have 60" seat height.

d. The lifeguard chair specified is prototypical for all new facilities constructed by the Owner. Substitutions will not be considered.

e. Color: White.

I. Underwater Lights

1. All underwater lights shall be IntelliBrite Architectural Series White LED as manufactured by Pentair Water Pool and Spa, or equal.

a. Underwater lights shall be LED. Incandescent lights will not be allowed.

b. Refer to equipment lists for required lumens and equivalent wattage sizes.

c. Light shall have tempered glass convex lens.

d. Furnish complete with stainless steel light niche and stainless-steel face ring. Coordinate cord length with Electrical Contractor.

2.04 POOL PROCESS FITTINGS

A. Skimmers

1. Skimmers shall be U-3 style as manufactured by Pentair Water Pool and Spa.
    a. Skimmer shall include equalizer port and float valve.
    b. Color: White.
    c. The skimmer specified is prototypical for all new facilities constructed by the Owner. Substitutions will not be considered.

B. Main Drain Suction Chambers

1. Large area main drains and feature suction chambers shall be unblockable, 18”x36” PVC drain covers with fiberglass sumps as manufactured by Daldorado, Lawson Aquatics, or equal.
    a. Drain covers shall be constructed of UV-stabilized PVC grating.
        1) Drain covers shall be APSP/ANSI/ICC-16 2017 compliant.
        2) Drain covers shall contain all required stamps and/or labels indicating compliance with the Virginia Graeme Baker Pool and Spa Safety Act.
        3) Drain cover shall have minimum open area of 62%.
        4) Components must meet ASTM G154 standards, requiring finished products to withstand 750 hours UV exposure.
        5) The top surface must have a raised, non-slip pattern to meet the static coefficient of friction, while wet or dry, in accordance with ASTM C1028.
        6) Drain cover must meet or exceed ASTM E661, which states allowable deflection at 200 lbs. and load to failure criteria.
    b. The main drains and feature suction drain covers shall be installed within a fiberglass sump supplied by the manufacturer and certified for use with the drain.
        1) Sump shall be custom manufactured for plumbing connections required.
        2) Sump shall be fabricated using fiberglass mat, marine quality resin and colored gel coat. The gel coat is only applied to the inside of the sump.
        3) Wall thickness of 0.19”.
        4) 2” FRP waterstop glassed onto sump.
    c. Color: White.
2. Strip style main drain suction chambers shall be unblockable, 4x32” PVC drain covers with PVC sumps as manufactured by CMP Pool Products, Waterway Plastics, or equal.
    a. Drain covers shall be constructed of UV-stabilized PVC grating.
        1) Drain covers shall be APSP/ANSI/ICC-16 2017 compliant.
        2) Drain covers shall contain all required stamps and/or labels indicating compliance with the Virginia Graeme Baker Pool and Spa Safety Act.
        3) Drain cover shall have minimum open area of 38.79 square inches.
        4) Drain cover shall not protrude beyond finished surface of pool by more than 1/8”
    b. Color: White.

C. Hydrostatic Relief Valve and Collector tube

1. Hydrostatic relief valve and collector tube as manufactured by Hayward, or equal.
    a. Hydrostatic relief valve shall be white ABS, spring loaded, with a leak proof self-cleaning O-ring seal, non-corrosive, and non-conductive.
    b. Hydrostatic relief valve collector tube shall be white ABS, with a minimum length of 12”.

D. Inlets

1. Directional wall inlets as manufactured by Pentair Water Pool and Spa, or equal.
    a. 1 ½” threaded directional eyeballs with snap in disks.
    b. Interchangeable with ½”, ¾”, and 1” orifices.
    c. Furnish orifice size as specified within the pool equipment list.
    d. Color: White.
2. Floor inlets as manufactured by Pentair Water Pool and Spa, or equal.
    a. Adjustable flow rate.
    b. Fully closeable for winterizing.
    c. Color: White.

2.05 POOL PROCESS EQUIPMENT

A. Gauges

1. Pressure and compound gauges shall be 4” liquid filled with stainless steel bayonet ring and cases as manufactured by Weiss Instruments, Inc., or equal.
    a. Case and Ring: 4” type 304 stainless steel case with polished stainless steel bayonet ring.
    b. Dial: White aluminum with black and red markings.
    c. Window: Clear acrylic.
    d. Tube: Phosphor bronze.
    e. Socket: Brass with push-in restrictor.
    f. Pointer: Black anodized aluminum, adjustable.
    g. Movement: Brass rotary type with bushings.
    h. Accuracy: 1% of gauge range.
    i. Connection: ¼” NPT bottom.
    j. Ranges: Vacuum, compound, pressure to 15,000 psi.
    k. Gauge shall be supplied complete with petcock and snubber.

B. Strainer

1. The Project Documents have been prepared utilizing equipment manufactured by Fluidtrol Process Technologies, Inc. Huntsville, AL as the basis of design.
2. Neptune Benson and Mer-Made are pre-approved equals for strainers.
3. Additional equals may be approved at the sole discretion of the Owner and Engineer.

4. The strainer system shall consist of a strainer body, a strainer lid, and a strainer basket. (Furnish spare strainer basket for every system).
    a. Each strainer shall come with a cover plate or lid with clear viewing window, gasket seal, hinged sealing hardware, two (2) stainless steel strainer baskets, drain and vent plugs.
    b. The hair and lint strainer shall be fabricated of Fiberglass Reinforced Plastic (FRP).
    c. The strainer shall be designed for a maximum operating pressure of 50 PSIG and a normal vacuum service of 14" of mercury, with a hydrostatic test pressure of 50 PSIG.
    d. The strainer system shall be installed with one influent PVC Vanstone flange and one effluent PVC Vanstone flange for horizontal connections.
    e. Unit shall include hinged securing assemblies to permit easy opening and closing of strainer lid without the use of tools.
    f. Basket shall self-center and remove in one simple motion.
    g. Basket shall provide a positive seal at the basket flange.
    h. The strainer lid shall be sealed to the body through the use of a food grade EPDM ring.
    i. The body and lid shall have PVC plugs complete with O-ring seals for draining and venting of the strainer.
    j. Exterior shall have UV protective inhibitors to maximize service life.
    k. The strainer basket shall be manufactured with 316 stainless steel.
        1) Open area of basket shall be no less than 4 times greater than the influent connection.

C. Self-Priming Centrifugal Pumps
1. Self-Priming Pumps 5 hp. and larger shall be EQ Series models as identified on the drawings manufactured by Pentair Water Pool and Spa.
    a. Pump shall include integral strainer with "see thru" lid.
    b. Pump shall be self-priming.
    c. Motor shall be premium efficient, totally enclosed fan cooled (TEFC) JMZ frame.
    d. Pump body shall be constructed of robust thermoplastic heavy-duty durable materials.
    e. Pump shall be designed for use in commercial applications and shall be listed and labeled to NSF 50 standard by an ANSI accredited certification organization.
    f. Pump shall be supplied with a spare strainer basket.
2. Self-priming Pumps 5 hp. and smaller shall be WhisperFlo XF VS models as identified on the drawings manufactured by Pentair Water Pool and Spa.
    a. Pump shall include integral strainer with "see thru" lid.
    b. Pump shall be self-priming.
    c. Motor shall include threaded shaft and durable commercial duty 56 frame motor with NEMA square flange.
    d. Pump body shall be constructed of robust thermoplastic heavy-duty durable materials.
    e. Pump shall have an integrated motor/drive.
    f. Pump utilizing a 4-20mA flow meter shall be provided with a digital input wiring kit.

g. Pump shall be designed for use in commercial applications and shall be listed and labeled to NSF 50 standard by an ANSI accredited certification organization.

h. Pump shall be supplied with a spare strainer basket.

D. Pool Pump Variable Frequency Drive (VFD)

1. Furnish complete VFD as specified herein and in the equipment schedule for loads designated to be variable speed. Basis of design is the Green Drive by Neptune Benson. VFD's by Danfoss or Pentair may be considered as equals.

2. Protective Features:

a. The VFD shall have input surge protection to withstand surges of 2.3 times line voltage for 1.3 msec.

b. End-of Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.

c. The VFD shall provide flow compensation to reduce energy by adjusting the set point to match changes in flow.

d. The VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor.

3. Interface Features:

a. The VFD shall provide an alphanumeric backlit display keypad. The VFD shall have the ability to display five different parameters about the VFD or load including: current, speed, DC bus voltage, output voltage, input signal in mA or other values from a list of different parameters.

b. The VFD shall include a Hand-Off-Auto disconnect switch on the face of the panel.

c. A red FAULT light, a yellow WARNING light, and a green POWER-ON light shall be provided.

d. Two level password protection shall be provided to prevent changes to the programming of the VFD.

e. The VFD shall include an internal clock that can be used for: timed actions, energy meter, trend analysis, date/time stamps on alarms, logged data, preventative maintenance, or other uses.

f. There shall be six fully programmable digital inputs for interfacing with the system's external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs.

g. The VFD shall have two analog signal inputs. Inputs shall be programmable for either 0-10V or 0/4-20mA.

h. The VFD shall be equipped with a standard RS-485 serial communications port and a front of drive accessible USB port.

4. Adjustments:

a. The VFD shall have an adjustable output switching frequency.

b. The VFD shall have four programmable "skip frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency.

c. The VFD shall include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.

d. The VFD will include a user selectable Reset function which enables the selection of between 0 and 20 restart attempts after any self-clearing fault condition (undervoltage, overvoltage, current limit, inverter overload, and motor overload).

e. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after power loss to prevent the need to manually reset and restart the VFD.

5. Service Conditions:

a. Ambient temperature to be 14 ^{O}F to 113 ^{O}F.

b. Relative humidity 0 to 95%.

c. Elevation to 3,300 feet without derating.

d. VFDs shall be rated for line voltage of 525 to 690 VAC, 380 to 480 VAC, or 200 to 240 VAC with +10% to -15% variation.

e. Line frequency variation of +2% shall be acceptable.

f. No side clearance shall be required for cooling of the units.

6. The VFD and all required options shall be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect. All enclosures shall be UL listed and labeled to meet the requirements of UL-508C. The unit shall be assembled by the VFD manufacturer in an ISO 9001 registered facility and completed tested by the manufacturer.

E. Sand Filtration Systems

1. Manufacturers

a. The filter system specified under this section shall be a pressurized Hi-Rate Permanent Media Filter design as manufactured by Neptune Benson, Pentair, Fluidra USA, or equal. Neptune Benson is the basis of design. Equipment by other manufacturers must fit within the footprint shown on the drawings.

2. Filter Area

a. The total effective filtration area of each tank shall be provided in accordance with the design requirements found within the Drawings.

3. Description

a. The filter system shall be listed and labeled for swimming pool/spa use to NSF/ANSI Standard 50 by an ANSI accredited certification organization. The filter certification shall be for a maximum flow of 20 gallons per minute per square foot of filter area.

b. The filter tank system shall consist of filter tank(s) as shown on the drawings, internal distribution system, internal air vent, manway opening/ cover, external vent and drain assembly. The tank(s) shall be manufactured in a fully assembled state with the external air vent disassembled for shipping. The filter(s) shall be designed and manufactured in a manner to allow for shipping under normal conditions without internal damage to the filter.

c. Filter Tanks

1) The filter tank(s) shall be constructed of fiberglass resin with a maximum working pressure of 50 psi, hydrostatically tested to 1.1 x maximum working pressure and designed to a minimum of 4:1 safety factor.

2) Each filter tank(s) shall consist of a body and two dished heads manufactured with a dual wall structure consisting of a contact molded inner structure and a filament wound outer structure. The inner structure shall be manufactured with Woven Roving and Chop Strand Mat on a male mold in a two or three-piece design, depending on length, and joined together with secondary joint(s) before applying the outer structure. The outer structure shall be filament wound in both radial and axial geometric patterns to provide maximum strength in all load directions. The dished heads and body thicknesses shall be designed according to ASME Section X requirements confirmed through calculations and a Finite Element Stress Analysis. The outer structure of the tanks shall be seamless and constructed of pigmented resin to provide a professional exterior finish.

3) Vertical filter tank(s) shall be mounted on a circular base that is permanently bonded to the tank. The tank support base shall be designed in compliance to all relevant seismic code requirements when anchored to the manufacturer's specifications.

4) A 16" round flanged manhole complete with FRP cover, O-ring-gasket and bolts shall be located in the body of the filter tank(s). All O-ring-gasket contact points on the manhole flange and cover shall have a smooth finish to provide a continuous watertight seal.

5) A 2'' combination media dump port and drain complete with an ABS media retainer and flange type closure shall be located in the side shell of the filter tank(s).

6) A ¾" external air relief complete with PVC ball valve shall be located in the side shell of the filter tank(s).

7) The influent and effluent ports shall be flanged to facilitate proper connection of both internal and external piping. The influent/ effluent ports shall consist of FRP flanges designed according to ASTM-PS 15-69-NBS with an ANSI standard 150 lb. bolt pattern.

d. Internal Distribution and Collection System

1) The filter tank equipment shall include an upper distribution system and lower collection system, hydraulically balanced to prevent filter media migration during filter operation and/ or backwash.

2) The upper distribution system shall include hydraulic diffusers manufactured of injection molded PVC plastic, located in multiple sets of two over the filter bed. They shall be piped to a Schedule 80 PVC distribution header with Schedule 80 PVC pipe and fittings appropriately sized to maintain proper flow velocities throughout the entire distribution system.

3) The lower collection system shall consist of a Schedule 80 PVC header and molded ABS plastic laterals with .009" tapered slots designed to retain a single grade of filter media with .23 mm particle size. The internal collection system shall be designed to promote media bed circulation during backwash while providing minimal head loss during filtration.

e. Filter Media

1) Filter media shall be Vitro Clean Aquatic crushed glass filtration media as manufactured by TriVitro Corp. and standard pea gravel.

2) Vitro Clean Aquatic

(a) Crushed glass filtration media.

(b) Specific Gravity: 2.50

(c) Bulk Density: 75-80 pounds per cubic foot.

(d) Effect Size: Ranges from 0.30 to 1.10 mm

(e) Coefficient of Uniformity: 1.45-1.80.

(f) Shape: Angular to sub-angular.

(g) Physical Composition: Amorphous soda-lime glass.

3) Pea Gravel

(a) Filter media bed.

(b) Specific Gravity: not less than 2.50.

(c) Particle Size: 1/8” x 1/4".

(d) Shape: sub-angular.

(e) Physical Composition: shall be free from minerals which may precipitate onto pool surfaces.

4) Filter media shall be NSF approved.

5) Install media quantities and depths in accordance with manufacturer’s instructions.

6) Filters shall contain pea gravel in the bottom of the filter up to the top of the lower laterals, approximately 25% of the total filter media by volume.

f. Pressure Gauge Panel

1) Systems utilizing prefabricated face piping shall include a pressure gauge panel.

(a) The pressure gauge panel shall consist of two 4½” diameter gauges scaled from 0-100 PSIG. The pressure gauges shall be mounted in an injection molded panel. The pressure gauges shall be connected to influent and effluent pressure points with air relief cocks, compression fittings and semi-rigid PVC tubing.

2) Systems utilizing field-fabricated face piping shall include a pressure gauge on the filter influent and the filter effluent piping.

g. Air Relief Valve.

1) All models shall be furnished with a snubber, piping, and valves for manual and automatic means of air release.

2) Operation instructions shall be permanently installed on the filter that include a warning statement not to start up the system after maintenance without first opening the air release and properly reassembling the filter and separation tank. This statement shall be readily visible from the area of the air release and the start-up controls.

h. Drain/Media Dump Port

1) All models shall include drain and media dump ports.

2) Drain out system shall consist of integrally molded fitting at the tank bottom with an ABS media retainer.

i. Data plate

1) Filtration system shall include a data plate in a conspicuous location that includes at minimum the following information: manufacturer name and address, filter model #, filter serial #, effective filtration area in s.f., filtration and backwash design flow rate in U.S. gallons per minute (specific to project/water body), maximum working pressure, and filtration rate (specific to each water body).

j. Prefabricated Face Piping

1) Where specified on the pool equipment list, face piping must be supplied by the same manufacturer as the filter tank and shall be pre-assembled by the manufacturer.

2) Valves shall comply with the requirements of Section 13 11 16.

3) The face piping shall be designed for a maximum working pressure of 50 psi.

4) The face piping shall include integral PVC Vanstone mating flanges for connection to the filter tank and field connected piping.

5) The face piping shall be fabricated in a fully assembled state by the filter manufacturer of Schedule 80 PVC pipe and fittings. Flanges shall be located to allow for easy disassembly to prevent damage during shipping.

6) The butterfly valves shall be constructed of PVC with aluminum handles. The valve shall have EPDM and PE that provide shut off up to 150 psi while sealing the valve stem from exposure to internal liquids. The face piping shall be certified by NSF International as an operational component for the filter system carrying the same pressure and flow ratings as the filter tank.

7) Face piping shall be furnished with a single-lever linkage to permit easy operation of the filter and transfer between operational modes (filtration and backwash). The operation valves, influent, effluent, backwash by-pass and backwash ports shall all be marked with identification labeling.

(a) A clevis and rod linkage system shall connect the butterfly valves furnished with the face piping. Simplified operation shall be achieved through the raising or lowering of a single operating handle.

(b) Connecting components shall vary in length to provide suitable mechanical advantage to operate the system. All valves shall operate simultaneously to eliminate the possibility of water hammer. The linkage components shall be constructed of T304 stainless steel designed to allow for individual valve adjustment to ensure proper positioning of the valves.

8) Single-lever linkage and connections shall be stainless steel. Shoulder bolts and Teflon bushings shall be used at every moving joint of the linkage. Valves shall be set to move concurrently, with one opening while the other is closing. Each valve shall be adjustable to provide for accurate positioning and tight shut off. The linkage shall have a locking pin to secure the valves in the filter position and to act as a locator for the backwash position.

F. Regenerative Media Filtration Systems

1. Manufacturers

a. The filter system specified under this section shall be a Regenerative Media Filter design as manufactured by Neptune Benson, Aqua Revival, or equal. Equipment by other manufacturers must fit within the footprint shown on the drawings.

2. Filter Area

a. The total effective filtration area of each tank shall be provided in accordance with the design requirements found within the Drawings.

3. Description

a. The filter system shall be listed and labeled for swimming pool/spa use to NSF/ANSI Standard 50 by an ANSI accredited certification organization.

b. Filter System

1) The primary components of the system shall consist of filter tank(s) as shown on the drawings, flexible tube filter elements, element assembly, media regeneration system, vacuum transfer system, precoat valves, sight glass, pressure gauges and system controller.

c. Filter System Capacity

1) The filter system shall consist of one filter tank per pool capable of meeting the design parameters shown in the pool data table in the Drawings

2) Filtration area shall be provided as specified and as certified to NSF Standard-50 to provide the specific filter rate. No modifications, manipulation or interpretation of these values shall be permitted.

3) The filter system shall be designed to maximize square footage of filter area while minimizing operating weight.

d. Filter Tank Construction

1) Carbon Steel Tanks

(a) Tank construction

(1) The filter tanks shall have a 60-inch side shell, suitable for 50 psi working pressure and hydrostatically tested to 75 psi.

(2) The tank shell shall be not less than ¼” thick.

(3) Bottom dished head shall be not less than ¼” thick.

(4) Top flat head shall be not less than 1 ½” thick.

(5) All material shall be Type A-36 carbon steel.

(6) All welding shall be performed by qualified operators. Joints shall be butt or fillet welded inside and out by manual or automatic process. Welded joints shall have complete penetration and fusion with little or no reduction of the thickness of the base metal. Welds shall be free of coarse ripples, grooves, overlaps, abrupt ridges, or valleys. All welded surfaces shall be chipped and brushed clean, when necessary, leaving no slag or splatter.

(7) Tank legs shall be constructed of 6” x 2 ½” channel legs ¼” thick. All 24”, 27” and 33” filters shall have three (3) legs. All 41”, 49” and 55” filters shall have four (4) legs. The material shall be Type A-36 carbon steel. Bearing plates shall be 10” x 5” x ½” type 304L stainless steel. Each bearing plate shall have two (2) 5/8” drilled holes to secure to the floor with ½” x 4 ½” stainless steel concrete anchors furnished. The legs shall be designed with bolted connections to minimize overall tank height for shipping and access into the mechanical room.

(8) The tank head shall be bolted to the shell with 7/8” diameter T304 stainless steel bolts, nuts, and washers, 9” on center around the tank perimeter.

(9) The tank shall be equipped with a UL listed grounding lug.

(10) The tank shall include a 12” diameter access port with cover, 6” viewing window, hardware to facilitate cleaning of tube elements and interior inspection of the filter and lift gland.

(11) The tank shall include brackets for mounting of the system controller, gauge panel, filter/regulator, vacuum blower, and vacuum hose rack.

(12) The tank shall include an integrally mounted hydraulic lifting device (davit). The davit assembly shall be designed to rotate 180-degrees for access to the tube sheet.

(b) Flexsol 3000 Interior Lining

(1) All interior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue. Lining shall be applied as soon as is practical on the same day blasting is done.

(2) Flexsol 3000 shall be a urethane, 100-percent solid plural component lining. Hardness shall be 75 durometer on the Shore D scale. Break tensile strength shall be 4,000 psi with elongation of less than 10-percent. Adhesion shall be greater than 2,500 psi.

(3) Application of Flexsol 3000 lining shall be done by experienced applicators using a high pressure, high temperature plural component system. All wetted surfaces including flange faces, manway rings and manway covers shall be lined to 100 mils +/- 10 mils WFT.

(4) Hardness shall be verified after curing to ASTM D 2240 standard.

(5) Manufacturer shall submit for approval a sample piece of coated steel to determine flexibility, abrasion tolerance and adhesion integrity.

(6) Flexsol 3000 linin shall meet the NSF toxicity standard unconditionally and shall be approved for use with the NSF approved filter.

(7) Flexsol 3000 lined vessels shall carry a ten (10) year limited non-prorated warranty.

(8) The filter manufacturer shall bear the responsibility for suitability of lining and shall be the sole source for the specified warranty.

(c) Exterior Coatings

(1) All exterior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue.

(2) Two coats of high solids enamel shall be applied for a total developed film thickness of 5-8 mils.

(3) Manufacturer shall supply minimum 16 oz of high solids enamel touch-up paint.

2) Stainless Steel Tanks

(a) Tank Construction

(1) The filter tanks shall have a side shell less than or equal to 50 inches tall, ASME Code stamped for 50 psi working pressure and hydrostatically tester per ASME Code Section VIII. All material shall be Type 304L or dual rated 304/304L stainless steel.

(2) All welding shall be performed by certified Code welders. All welds to be neat in appearance, free from slag and other defects, ground and polished to minimum 63 RMS. All stainless-steel tanks must be passivated post hydrostatic test.

(3) All tanks must have four (4) legs. Tank legs shall be constructed of 304/304L stainless steel. Bearing plates shall be a minimum ¼” type 304/304L stainless steel. Each bearing plate shall have one (1) 5/8” drilled holes to secure to the floor with the ½” x 4-1/2” stainless steel concrete anchors furnished. For systems installed onto steel deck equipment platforms, filters shall be bolted, not welded to the equipment platform deck.

(4) The tank cover flange shall be bolted to the shell flange with ASME Section VIII approved hardware. Filters that do not incorporate full tank cover flanges shall not be considered.

(5) The tank shall incorporate ASME viewing window (sight glass).

(6) The tank shall include brackets for mounting of the system controller, unless specified for wall mounting.

e. Internal Components

1) The filter shall consist of flexible tube elements, filter tube sheet and internal flow diversion assembly.

2) Filter elements shall be flexible tubes that provide support for the media. The outer wall of each filter element shall be fabricated of multi-filament high strength polyester braid. Each element shall have an internal T316 stainless steel spring, which acts as a support structure for the braided filament.

3) The filter element tube sheet shall be fabricated of PVC or 304L stainless steel and provide both support for the top of the element assembly as well as the watertight seal.

4) All stainless-steel wetted fasteners shall be Type 316.

f. Filter Tank Connections

1) Each filter tank shall be equipped with necessary flanges and connections for internal and external piping. Connections shall be comprised of 1” minimum thickness fiberglass flanges with ANSI class 150 standard bolt pattern. Connections requiring bolt-thru hardware will not be accepted.

2) The filter tank shall incorporate flanged connections for filter influent and filter effluent.

3) The filter tank shall incorporate connections for drain and vacuum transfer piping.

4) The filter tank drain-out system shall consist of a single elbow integral to the tank bottom head.

g. Media regeneration system

1) System shall include the manufacturers standard media regeneration system.

h. Filter System Controller

1) The control panel shall allow the user to initiate a completely automatic media regeneration sequence.

2) The filter system controller shall be provided by the filter manufacturer.

i. Vacuum Transfer System

1) A vacuum transfer system shall be furnished to allow the recharging of media into the filter for either bag or bulk media.

2) The manufacturer shall furnish all necessary pipe, fittings, and hardware for field plumbing of the vacuum transfer system.

j. System Valves

1) Each filter shall include system valves to facilitate system fill after media recharge, precoat/regeneration, influent and effluent for filtering and media dump/drain valve.

2) The precoat/regeneration and effluent valves shall be butterfly type with pneumatic actuators.

k. Valves

1) Valves shall be butterfly valves and shall be installed for influent, effluent, precoat and media regeneration system valves.

l. Pneumatic Actuators

1) Each filter shall include pneumatic actuators for one (1) effluent valve, one (1) precoat valve and three (3) media regeneration valves.

2) Actuators shall be double acting with valve mounted drilling to ISO 5211.

3) The actuators shall include two (2) 1/8” or 1/4” FPT ports for open/close connections. Flow control valve with quick connect fitting shall be installed at each port to allow speed control adjustment for the open/close function of the actuators.

m. Air Compressor

1) The filter system will require one (1) air compressor per mechanical room as recommended to meet the filter manufacturer’s specifications.

n. Filter Media

1) Media shall be expanded perlite with a median particle size of 37 microns. Percentage retained on a +150 Tyler Mesh shall not be less than 8% or more than 25%. Darcy permeability shall be between 1.2-1.85.

2) The media shall contain no more than one-tenth of one percent (0.001) of crystalline silicate.

3) The media shall be certified by the Manufacture for use in the filters. The media shall be NSF Standard-50 listed.

o. Media Separation

1) Media separation shall be furnished as specified in the Drawings.

p. Filter Cleaner

1) Each filter system shall be furnished with one (1) charge of chemical for cleaning and degreasing of filter tube elements.

q. Warranties

1) Provide manufacturer's standard warranties.

G. Automated Chemical Controllers

1. Automated chemical controllers for Indoor Spas shall be the Thor L800 Digital Controller, as manufactured by Energy Resource Products, LLC, and shall include sensors for pH, ORP, temperature, and free chlorine (non-stabilized water). Automated chemical controllers for Outdoor Pools shall be the Thor L800 Digital Controller, as manufactured by Energy Resource Products, LLC, and shall include sensors for pH, ORP, temperature, and total chlorine (stabilized water). Additional conductivity sensors shall be included with chemical controllers for all pools and spas.

a. The automated chemical controller is prototypical for all new facilities constructed by the Owner. Substitutions will not be considered. For purchasing information contact Hercules Solutions LLC. www.herculessolutionsllc.com Telephone 866.749.8139

b. The automated chemical controller shall be installed with manufacturer furnished sample stream strainer.

H. Ultraviolet Disinfection Systems

1. The ultraviolet disinfection system shall be a Sentry UV system as manufactured by ChlorKing, or equal.

a. The UV sterilizer for the body of water shall be low pressure, high output amalgam.

b. The UV system shall be NSF International Standard 50 listed and certified for use in pools and spas.

c. The UV system shall be comprised of one power supply and one sterilizing chamber (number of lamps in chamber varies with model).

d. The UV chamber shall be capable of being mounted horizontally or vertically.

e. The UV chamber shall be constructed of CPVC or stainless steel (varies with model).

f. The UV system shall have quick disconnect sleeves for easy removal for maintenance and cleaning.

g. The UV system shall include a strainer.

h. The UV system shall be pre-wired, ready for field connection of power tied to the pool pump and control circuits.

i. The UV system shall be capable of operating at 254 nm for sterilizing and 185 nm for oxidizing.

j. The UV system shall include all necessary piping, valves, etc. for a fully operating ultraviolet disinfection unit capable of full recirculation flow bypass.

k. The UV system shall have a light intensity meter monitoring the 254 nm wave length.

l. The UV system shall have an hour meter for tracking operation hours of lamps and sleeves.

m. The UV system shall be capable of functioning in water temperatures between 50 and 130 degrees Fahrenheit.

n. The UV system shall operate at a minimum of 45 mJ/cm^2.

o. The UV system for the spa shall come complete with two (2) 2” attachment nipples on the chamber for connection of bypass flow per Drawings.

I. Thermometers

1. Thermometers shall be 9” industrial glass thermometers as manufactured by Weiss Instruments, Inc., or equal.

a. Thermowells: 304 stainless steel thermowell supplied by thermometer manufacturer.

b. Case: Modern V-shape design with parts molded of GE Valox polyester, in black textured finish. Heavy glass protected front firmly secured against rattles by spring action.

c. Stem: Precision die cast Zamac alloy.

d. Locking device: Adjustable case locknut and angle adjusting screw to provide 360-degree positioning of thermometer case and stem.

e. Tube and Capillary: Blue liquid filled-magnifying lens “Blue Reading” tube. Silicone shock mounted.

f. Range: 0-160 °F.

g. Accuracy: 1% of scale range.

h. Scale: White coated aluminum with permanently baked bold black markings. Locked in place and adjusted through device at top of scale.

J. Heat Exchanger Flow Switch

1. Flow Switch shall be McDonnell and Miller, Series FS4-3S Flow Switch, stainless steel body, 1½” NPT pipe connection.

K. Chemical Feed Pump

1. Chemical feed pumps shall be a single head adjustable output peristaltic pump as manufactured by Stenner Pump Company, or equal.

a. Pump shall be peristaltic with a 3-point roller design to assist in anti-siphon protection.

b. Pump shall be self-priming against maximum working pressure.

c. Pump shall be listed and labeled NSF/ANSI Standard 50 by an ANSI accredited certification organization.

d. Pump sizes and output requirements vary, refer to equipment lists.

L. Flow Monitor System

1. Recirculation system flow meters shall be 9900 SmartPro Transmitter as manufactured by Georg Fischer Signet LLC, or equal.

a. Flow monitor system shall come complete with magmeter flow sensor (from same manufacturer).

1) Flow sensor shall produce a blind digital/frequency, relay output.

2) Flow sensor shall have a flow range of 0.5 to 33 ft/s.

3) Flow sensor shall have no moving parts.

4) Flow sensor shall be capable of bi-directional flow and empty pipe detection.

5) Flow sensor shall be constructed of corrosion resistant materials.

b. Flow monitor shall be supplied complete with rear cover kit.

c. Flow monitor shall include a backlit LCD for displaying instantaneous flow rate readings, totalized flow volume and for calibration/setup.

d. Flow monitor shall include a fully scalable active (internally powered) 4-20 mA output.

e. Flow monitor shall include two programmable relays.

f. Device shall have NEMA 4X, CE, and UL approvals/ratings.

g. Accuracy: 0.5% of reading.

h. Enclosure: ABS plastic.

i. Keypad: Silicone rubber.

j. Panel and Case Gasket: Neoprene.

k. Window: Shatter-resistant glass with UV coating.

M. Accessory Flow Meters and Sensors

1. Water feature and accessory system flow meters 6” and smaller shall be FlowVis manufactured by H2Flow, or equal.

a. Accuracy: 3% of scale range

2. Water fill system flow sensors shall be Georg Fischer Signet LLC paddlewheel flow sensors.

a. Flow sensor shall produce a blind 4 to 20 mA, digital/frequency, relay output.

b. Flow sensor shall have a flow range of 1 to 20 ft/s.

c. Flow sensor shall be constructed of chemically resistant materials.

d. Flow sensor shall have an easily replaceable rotor.

e. Body: Polypropylene.

f. Rotor: Black PVDF.

g. Pin Material: Titanium.

N. Water Level Controller

1. The water level controller shall be the Levelor K-1100 as manufactured by Jandy, or equal.
    a. An electronic multi water level sensing control system shall be furnished.
    b. The water level controller shall come complete with solenoid valve, slip sensor, and sensor housing.
    c. Controller
        1) Housing and Mounting: The controller shall be housed in a watertight polycarbonate enclosure. The enclosure and connections shall be designed to eliminate any possibility of corrosion and/or damage to the internal components of the controller. The controller shall be factory wired and tested for functionality.
        2) Indicators: The controller shall have colored LED indicators indicating applicable system conditions (power, sensor, filling).
        3) Timings: Fill on delay shall be 20 seconds. Fill off delay shall be 20 seconds. Max fill time shall be adjustable from 20 to 60 minutes and shall be able to be disabled for continuous filling.
        4) Outputs: The solenoid valve output shall be one (1) solid state relay output at 24VAC, 1 A.
    d. Sensors
        1) Sensors shall be capable of detecting water levels within 1/8” of nominal water level.

O. Chlorine Generation System

1. Chlorine generator system shall be a NexGen system manufactured by ChlorKing.
    a. System to be supplied with supplemental feed panels to accommodate chlorine feed to each additional pool. The chlorine generation system procured directly by the Owner.
    b. System shall be vented to the exterior through PVC piping by Pool Contractor. Connection to the system shall be made via a pre-manufactured connection that will ensure an air tight seal.

P. Secondary Containment Pallets

1. Secondary containment pallets for liquid storage containers shall be constructed of high density polyethylene with removable grate as manufactured by Eagle Manufacturing Company, or equal. Designs that include a drain will not be allowed.
    a. Pallets storing pH balancing chemicals shall be capable of supporting four 15-gallon carboys of liquid. Each pallet shall have a minimum capacity of 30 gallons.
    b. Pallets storing sodium hypochlorite shall be capable of supporting four 55-gallon barrels of liquid chemicals. Each pallet shall have a minimum capacity of 66 gallons. Furnish with one pallet ramp for the facility.

2.06 POOL COMPETITION EQUIPMENT

A. Racing Lane Lines

1. Racing lane lines shall be Competitor racing lanes and Gold Medal racing lanes as manufactured by Competitor Swim Products, or equal.
    a. 6” diameter racing lanes shall be utilized on all outdoor applications.

b. Competitor race line products are prototypical for all new facilities constructed by the Owner. Substitutions will not be considered.

c. Lane lines shall be supplied complete with assembly and attachment accessories, including a bronze nickel-plated spool encased in a stainless steel tension mechanism to provide customized adjustment of lane torque at one end and a stainless steel spring assembly at the other end to maintain equal pressure during use.

d. All hardware shall be stainless steel or plastic.

e. Color and Pattern:

1) Outdoor Lap Pool: 6" diameter.

(a) Full length: Alternating blue and white color with solid blue color ends (15' each end) for full length lane dividers. Furnish red colored single disc marker at 15 meters from each end of the lap lanes.

B. Rope Anchors

1. Refer to 2.03.C. of this section for identical equipment.

C. Stanchion Posts

1. Refer to 2.03.D. of this section.

2. Backstroke rope and flags by Owner.

D. Starting Block Platform

1. Starting block platform shall be the Velocity Side Step Platform with Track Start Wedge as manufactured by S.R. Smith, Track Start Side Step Platform with Adjustable Backplate Kit as manufactured by KDI Paragon, or equal.

a. Starting block platform shall be supplied complete with square base wedge anchor.

b. Starting block platform frame shall be powder coated. Color similar to S.R. Smith Silver Gray RAL7038.

c. Starting block platform shall have slip resistant surface on footboard, wedge, and side step similar to S.R Smith TrueTread. Surface color shall be Blue. Sand finish surfaces will not be accepted

d. Starting block platform shall include "H" configuration backstroke handle.

e. Starting block platform shall be supplied complete with starting block cover and locking mechanism. The cover shall be customized with a hole on each side (midpoint) to allow for the cable of the locking mechanism to be threaded through the cover holes and through the starting block rail supports for security and prevention of cover removal/tampering.

1) Starting Block Cover 24x32 Inches, White as manufactured by S.R. Smith or Track Start Safety Cover (24"x32") as manufactured by Paragon Aquatics, I.D. No. 23967,

2) Adjustable Cable, 6' adjustable cable length, as manufactured by Master Lock, No. 8417D. Locks shall be keyed identically.

2.07 POOL ACCESSORY FEATURES AND EQUIPMENT

A. Pool Accessory Features

1. Umbrella Feature

a. Umbrella feature shall be as manufactured by Rain Drop Products, LLC, or equal.

b. The specified feature shall be suitable for installation in public swimming facilities and shall be capable of accommodating various rates of water flow from 100-400 gallons per minute.

c. The supplier shall furnish feature complete with all anchoring and fastening devices, required gaskets and base skirt.

d. Design

1) The stem and the umbrella shall be fully assembled in two pieces so that either piece can be individually replaced should damage or vandalism occur.

2) Minimum clear height of 8’ below umbrella.

3) All materials shall be inert to pool chemicals.

4) The umbrella shall be molded fiberglass with a high gloss gel coat finish on the exterior. Colors shall be ultraviolet stabilized to inhibit fading and selectable from manufacturer’s standard palette.

5) The stem/piping shall be twelve inch rigid corrosion proof fiberglass material with a gel coat finish. Attachment flanges shall provide six (6) ¾ inch bolt holes for mounting to umbrella and shall have a similar bolt pattern (6 holes) at the base of the stem. PVC is not acceptable and shall not be used for stems. Colors shall be ultraviolet stabilized to inhibit fading and selectable from manufacturer’s standard palette.

6) Gaskets shall be ¼ inch thick neoprene material.

7) Fasteners shall be type 304 stainless steel for anchor bolts that attach the dome to the stem. Anchor bolts for mounting to foundation shall be thunder stud expansion type anchor bolts. All fasteners shall be supplied by the manufacturer.

8) Base skirt shall be a two piece ABS molded plastic that rigidly attaches to the stem. Colors shall be ultraviolet stabilized to inhibit fading and selectable from manufacturer’s standard palette.

e. Stem color: Rain Drop “Coastal Cool”.

f. Dome color: Rain Drop “Aquamarine”.

2. In-Ground Feature

a. In-ground feature shall be “Pop Jets” as manufactured by Rain Drop Products, LLC, or equal.

b. The specified fountain shall be suitable for installation in zero entry public swimming facilities and shall operate at a water flow rate of 60 gallons per minute.

c. Design

1) The body shall be manufactured from heavy duty, high tensile strength PVC, gas welded and shall be impervious to rust and corrosion.

2) The nozzle shall be adjustable high strength, corrosion resistant HDPE.

3) All nozzles and piping connections shall be made from heavy-duty high tensile strength PVC.

d. Manufacturer to supply high strength PVC plugs and installation instructions for winterization.

B. Pool Accessory Feature Fittings

1. Refer to 2.04 of this section for identical equipment.

C. Pool Accessory Feature Equipment

1. Refer to 2.05 of this section for identical equipment.

2.08 SURGE TANK EQUIPMENT

A. Access Hatch

1. Surge tank access hatch shall be type “K-2” as manufactured by Bilco Company, or equal.
2. Size: 30” x 30”.
3. Cover: Shall be reinforced to support a minimum live load of 150 psf with a maximum deflection of 1/150th of the span.
   a. The vault access door shall be single leaf and pre-assembled from the manufacturer.
   b. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing
   c. Operation of the cover shall not be affected by temperature.
   d. Cover shall be constructed of ¼” aluminum diamond pattern plate.
   e. Cover shall be equipped with a steel hold open arm that automatically locks the cover in the open position.
   f. Cover shall be fitted with the required number and size of torsion bars.
4. Frame: Shall be ¼” extruded aluminum with strap anchors bolted to the exterior.
5. Hinges: Shall be specifically designed for horizontal installation and shall be bolted to the underside of the cover. Cast steel cam-action hinges which pivot on torsion bars shall be furnished.
6. Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.
7. A removable exterior turn/lift handle with a spring-loaded ball detent shall be furnished to open the cover.
8. A type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
9. All hardware shall be type 316 stainless steel.
10. Factory finish for indoor surge tank hatch shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

11. Factory finish for outdoor surge tank hatch shall be mill finish aluminum with powder coating applied to all visible parts of the frame and door (when door is closed).
    a. Two coats of powder coating for exterior commercial use with heavy pedestrian traffic. Coat twice to obtain 3.5 – 5 mils thickness on edges and corners.
        1) Color: To match deck paver color, by Owner.

B. Manhole Steps
1. Manhole steps shall be mechanical lock style as manufactured by American Step Company, Inc., or equal.
2. Steps shall be constructed of grade 60 steel reinforcement surrounded (completely) by a formed step constructed of copolymer polypropylene.
3. The steps shall meet or exceed ASTM C478 and OSHA standards when properly installed.
4. The step surface shall be textured or patterned to provide a non-slip surface.

2.09 MAINTENANCE AND CLEANING EQUIPMENT

A. The Pool Contractor shall supply the following maintenance and cleaning equipment:
1. Pool Vacuum System
    a. Pool vacuum system as manufactured by Pool Weasel, or equal.
    b. Complete pool vacuum system shall include:
        1) Pool Weasel vacuum base unit.
        2) 75’ of 1 ½” heavy duty vacuum hose.
        3) 12’-22’ telescopic fiberglass pole.
        4) 29” vacuum head.
        5) 12” clear vinyl spa algae vacuum head.
        6) 3’ brown spiral return line.
        7) 50’ lite plug extension cord.
        8) Hose hugger.
        9) Tube of magic lube.
        10) Waste adapter.
2. The following cleaning accessories as manufactured by Pentair Water Pool and Spa, or equal:
    a. Heavy duty skimmer, aluminum rod and frame.
    b. 18” wall brush with stainless steel algae bristles.
    c. Fiberglass telescoping pole, 8’-0” to 16’-0”.
3. Complete commercial pool test kit as manufactured by Taylor Technologies, or equal.

2.10 ACCESSIBILITY EQUIPMENT

A. Pool Lifts
1. Stationary pool lifts shall be the aXs2 lift as manufactured by S.R. Smith.
    a. Pool lift shall be supplied complete with battery, charger, battery console cover, waterproof control, stainless steel anchor socket (with cover), footrest and seat belt assembly.

b. Pool lift specified outdoors shall be supplied with a caddy.

c. Pool lift specified indoors shall be caddy-compatible.

d. Pool lift shall be supplied with arms rests.

e. Pool lift shall be 3rd party tested and verified ADA compliant.

f. Pool list shall have 300 lb. lifting capacity.

g. Pool lift shall be easily removable from stainless steel deck anchor.

h. Pool lift shall be constructed of powder-coated stainless steel and aluminum. Powder coated stainless steel color shall be similar to brushed stainless steel, equal to S.R. Smith “Silver Gray” RAL7038.

i. Pool lift specified is prototypical for all new facilities constructed by the Owner. Substitutions will not be considered.

B. Transfer Rails

1. Transfer rails shall be TR-12B-LT as manufactured by S.R. Smith.

a. Transfer rail shall be fabricated of 1.50” O.D. x 0.120” wall thickness, 304 stainless steel.

b. Transfer rails shall be wrinkle free.

c. Transfer rails shall have a baked powder coat finish that includes a primer, basecoat, and clear coat finish. The powder coat system shall have a minimum total thickness of 5 mil over the entire exterior surface of the rail. Color to be similar to brushed stainless steel, equal to S.R. Smith “Silver Gray” RAL7038.

d. Transfer rails shall be manufactured to conform to setbacks and lengths as indicated within the Drawings.

e. Transfer rails shall comply with the 2010 ADA Standards for Accessible Design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify conditions prior to start of work and notify General Contractor of any discrepancies between encountered conditions and those indicated within the Drawings and herein.

3.02 PREPARATION

A. Protect all adjacent surfaces, equipment, etc. to remain from damage during course of work. Restore any damaged areas or equipment.

3.03 INSTALLATION

A. Install all equipment in accordance with manufacturer’s recommendations.

B. Furnish all appurtenance and ancillary equipment necessary for complete installation of all equipment.

C. Install all work and equipment plumb, true, square, straight, and level. Anchor securely in place per manufacturer’s recommendations or in accordance with general industry practices.

D. All equipment shall be labeled for each system.

E. Health, Life, and Safety Equipment

1. Lifeline rope and floats.
    a. Install lifeline rope and floats prior to final acceptance.
    b. Utilize clamp-type rope hooks for connection to cup anchors at pool wall.
        1) Trim all rope ends within ½ inch of clamp and treat ends to prevent fraying.
    c. Ensure rope is installed tight with minimum sag.
    d. Install floats at minimum five foot spacing. Space floats evenly across length of lifeline.
2. Life hook.
    a. Install life hook pole hangers utilizing hardware provided by manufacturer. Install at locations necessary for compliance with jurisdictional requirements.
    b. Prior to installation, obtain approval of location from General Contractor, Owner, or Architect.
3. Ring buoy.
    a. Install ring buoy hangers utilizing hardware provided by manufacturer. Install at locations necessary for compliance with jurisdictional requirements.
    b. Prior to installation, obtain approval of location from General Contractor, Owner, or Architect.
4. Lifeguard chair.
    a. Fully assemble lifeguard chair.
5. Underwater Lights
    a. Install conduit in pool structure prior to placement of concrete. Pool Contractor shall supply and install conduit to five (5) feet behind the pool wall (remaining conduit by Electrical Contractor).
        1) Install niche in formwork prior to placement of concrete (protect face and interior from concrete).

            (OR)

        2) Create grout pocket for installation of niche following concrete placement.
            (a) Scarify grout pocket bonding surface to minimum one-quarter (1/4) inch amplitude.
            (b) Install light niche and grout in place.
    b. Installation of light, electrical connections, and grounding by Electrical Contractor. Coordinate work and assist in final light and face ring installation.
6. Signage
    a. Contractor shall coordinate with Owner required sign location for compliance with applicable jurisdictional requirements.
    b. Pool Contractor is responsible for ensuring that the appropriate signage is in compliance with all jurisdictional requirements and typical industry standards.

F. Pool Process Fittings

1. Hydrostatic relief valve and collector tube.

a. Hydrostatic relief valves shall be installed in each main drain and accessory feature sump.

b. Install extension between relief valve and collector tube to allow placement of tube below concrete sump. Ensure that all tube openings lie completely within the rock base below the concrete sump.

2. Inlets

a. Balance inlet system. Adjust flow and direction of all inlets for optimum distribution and circulation within pool.

G. Pool Process Equipment

1. Strainers

a. Install strainer at appropriate elevation for pump placement and piping.

b. Install a concrete equipment pad below the strainer at the determined elevation prior to strainer operation (filling with water).

c. Ensure strainer weight is distributed to the concrete pad with no strain transmitted to the connecting pipes.

2. Horizontal Close Coupled End Suction Centrifugal Pumps

a. Install pump at appropriate elevation for piping connections and to ensure flooded suction (to top of volute). Notify Engineer immediately if sufficient pump pit depth is not available to provide flooded suction. The Contractor shall be responsible for verifying that flooded suction is attainable prior to final installation of the pump.

b. The Contractor shall ensure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.

c. A permanent concrete equipment pad shall be installed below the pump as detailed in the Drawings prior to operation.

d. Drilled-in expansion anchors that rely solely on friction shall not be used for anchoring of the pumps. Cast-in-place anchor bolts are preferred. Alternately, epoxy-grouted anchor bolts may be considered with approval of the Engineer where drilled-in anchors are necessary. The anchors shall be installed such that the pump motor can be easily removed for maintenance.

e. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

3. Self-priming Centrifugal Pumps

a. Install pump at appropriate elevation for piping connections.

b. The Contractor shall insure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.

c. The pump shall be permanently anchored to a concrete equipment pad or the concrete floor slab. The anchors shall be installed such that the pump motor can be easily removed for maintenance.

d. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

4. Variable Frequency Drives

a. Contractor to verify that job site conditions for installation meet factory-recommended and code-required conditions for VFD installation including clearance spacing, temperature, contamination, dust, and moisture of the environment.

b. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

c. A factory-authorized service technician shall perform start-up on each drive. A start-up service report shall be provided.

d. Contractor to include in their Operations Manual and Instructional Training directions to manually override the pre-programmed flow rate to meet the required backwash flow rate or drain-down flow rate.

1) The backwash rate and drain-down flow rate shall be printed on labels and placed on the VFD housing.

e. VFDs connected to recirculation, feature, or hydrotherapy pumps shall be programmed to maintain the design flow rate. The design flow rate shall be calculated with the pump operating at full speed utilizing the pump pressure, vacuum gauges, and pump curve. Calculated flow rate shall be within 5% of the design flow rate.

5. Sand Filtration Systems

a. All sand filters shall be set level according to the manufacturer's instructions and recommendations.

b. Support media shall be placed by hand to avoid damage to the filter internal components.

c. Support media shall be leveled before the addition of the upper layer of filter media.

6. Automated Chemical Controller

a. Thor L800 chemical controller to be installed with low voltage wiring by a factory trained representative.

b. Calibrate and program the chemical controller on all pools and spas to include the following functionality:

1) Sample Stream Magnetic Flow Switch

(a) Factory wired to Digital Input "1" for single vessel installation – Digital Input "5" for second vessel if applicable

(b) Data Log Flow/No Flow through sample stream

(c) Lock out chemical feed if no flow

2) Sample Stream pH Probe

(a) Connected via M12 connector on factory provided Data/Power modbus cable

(b) Data Log pH

(c) Initiate pH feed if pH is 7.5 or above

(d) Stop pH feed if pH is 7.3 or below

3) Sample Stream ORP Probe
   (a) Connected via M12 connector on factory provided Data/Power modbus cable
   (b) Data Log ORP
4) Sample Stream Temperature Probe
   (a) Shall be integrated with pH/ORP sensor
   (b) Data Log temperature (^{O}F)
5) Lyzner Saturation Index
   (a) Manual input calcium hardness (ppm)
   (b) Data log calcium hardness
   (c) Data log calcium hardness input date and time
   (d) Manual input alkalinity (ppm)
   (e) Data log alkalinity
   (f) Data log alkalinity input date and time
   (g) Data log calculated Lyzner Saturation Index based on manually input calcium hardness and alkalinity
6) Recirculation Flow (gpm)
   (a) Field wire 4-20mA signal from flow transmitter to input “2” for single vessel and input “6” for second vessel (where applicable)
   (b) Data log recirculation flow (gpm)
   (c) Lock out chemical feed if no flow
7) Fill Water Sensor
   (a) Field wire pulse input from flow sensor to input “2” for single vessel and digital input “6” for second vessel (where applicable)
   (b) Data Log totalized fill water (gallons)
8) pH Feed Factory Whip
   (a) Factory wired to output “2” for single vessel and output “6” for second vessel (where applicable)
9) Chlorine Feed Factory Whip
   (a) Factory wired to output “1” for single vessel and output “5” for second vessel (where applicable)

c. Additional calibration and programming the required on all indoor pools and spas also include:
   1) Sample Stream Free Chlorine (PPM) Probe
      (a) Factory Wired to Analog Input “1” for single vessel and Analog Input “5” for second vessel (where applicable)
      (b) Data Log free chlorine

(c) Send feed signal to chlorine feeder if free chlorine falls below 1.0 ppm on pools or 2.0 ppm on spas

(d) Stop chlorine feed when free chlorine reaches 1.5 ppm or above on pools and 3.0 and above on spas

d. Additional calibration and programming the required on all outdoor pools and spas to also include:

1) Sample Stream Total Chlorine (PPM) Probe

(a) Factory wired to Analog Input “3” for single vessel and Analog input “7” for dual vessel (where applicable)

(b) Data Log total chlorine

(c) Send feed signal to chlorine feeder if free chlorine falls below 1.5 ppm on pools or 2.5 ppm on spas

(d) Stop chlorine feed when free chlorine reaches 2.0 ppm or above on pools and 3.5 and above on spas

e. Additional calibration and programming the required on all pools and spas to also include:

1) Sample Stream Total Conductivity Probe

(a) Field connected via M12 connector on factory provided Data/Power modbus cable

(b) Data Log total dissolved solids (ppm)

7. Thermometers

a. Each pool recirculation system shall include the installation of a minimum of three (3) thermometers.

1) One (1) thermometer shall be installed in the main piping (full flow) after the heater bypass and one (1) thermometer shall be installed on each heat bypass inlet and outlet.

8. Chemical Feed Systems

a. Chemical feed pumps shall be located within the chemical enclosure. All chemical tubing from the feed pump to the pool return piping shall be continuous without splices, breaks, etc.

b. Chemical feed injection points are to be installed after all equipment bypasses and all sample stream returns. Injection points shall be at the lowest elevation feasible and in close proximity to the point where the recirculation return pipe (to pool) exits the equipment room.

9. Flow Monitor System

a. Applicability

1) Flow monitor system shall be utilized as main flow sensing instrument for all pool recirculation systems.

b. Install minimum straight pipe lengths for flow sensor as required by manufacturer. Install additional straight line piping runs as required.

c. Flow monitor to be wired to the chemical controller for data logging.

d. Calibrate flow monitor system during pool recirculation system start-up based on the calculated flow rate with the pump operating at full speed utilizing the pump pressure, vacuum gauges, and pump curve. Displayed flow rate to be accurate within 2% of the calculated flow rate.

10. Accessory Flow Meters and Sensors

a. Applicability

1) FlowVis flow meter shall be utilized as flow meter for all water feature systems that are 6” or smaller and heat exchanger bypass piping.

(a) Flow meter shall be installed on heat exchanger influent piping after the service valve and within eyesight of the heat exchanger bypass valve.

2) Paddlewheel flow sensors shall be utilized for all water fill systems (individual water fill to each vessel).

b. Install minimum straight pipe lengths for flow sensor as required by manufacturer. Install additional straight-line piping runs as required.

11. Water Level Controller

a. The sensor housing for spa water level control systems shall be installed within a field fabricated deck well as indicated within the Drawings.

b. The sensor housing for pool water level control systems shall be installed within a field fabricated assembly fastened to the surge tank wall as indicated within the Drawings.

END OF SECTION

SECTION 13 24 16.24
PREFABRICATED EXTERIOR SAUNAS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes prefabricated exterior saunas.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 06 10 00 - Rough Carpentry.

F. Section 06 20 00 - Finish Carpentry.

G. Section 07 21 00 - Thermal Insulation.

H. Section 10 14 00 - Signage.

I. Section 13 24 16 - Saunas.

1.03 REFERENCES

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

C. IEC 60335-2-53 - Sauna and Infrared Cabins; Current Edition.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. PS 1 - Structural Plywood; 2023.

F. PS 20 - American Softwood Lumber Standard; 2025.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installers: Certified by Sauna Manufacturer to install their products.

C. Source Limitations: Obtain saunas components through one source from a single manufacturer.

D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

E. 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.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1, Section - "Project Management and Coordination."

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, sauna heater rated capacities and effective room volumes, and accessories.

B. Shop Drawings: Include dimensioned plans, elevations, sections, and large-scale details.
   1. Show sauna heater dimensions, mounting location, required clearances, and controls.
   2. Include methods of connection for sauna heater, lighting, and controls.
   3. Show field measurements, locations and sizes of blocking and reinforcements, and attachments to other work.

C. Samples: For each exposed wood member, full board width by 12 inches (305 mm) long.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

F. Warranty: Special warranty specified in this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store sauna materials and components flat and blocked off the ground.

B. Store saunas in areas where temperature and relative humidity are maintained at occupancy levels.

C. Store saunas in Manufacturer's original packaging as recommended by Manufacturer until ready for assembly.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install saunas until substrate and adjacent landscaping is complete.

B. Field Measurements: Verify openings and dimensions for precut saunas by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Locate concealed framing, blocking, and reinforcements that support precut saunas by field measurements before being enclosed and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Nordica.
   2. Or approved equal.

2.02 PREFABRICATED EXTERIOR SAUNAS

A. General: Prefabricated Exterior Sauna with wood and glazed cabin and pre engineered heaters and controls. Saunas are to comply with the requirements of IEC 60335-2-53, NFPA 70 and the AHJ, as well as additional standards listed below.

B. Cube Sauna:
   1. Product: Nordica Model CL7G.
   2. Assembled Dimensions (exterior): 86.6" x 91" x 93" high.
   3. Assembled Dimensions (interior): 70.8" x 87.5" x 85.5" high.
   4. Glazed door by Manufacturer.
      a. Tempered Bronze.(See Section 08 81 00 for requirements for tempered glass)
   5. Heating Elements:
      a. Saunum Air L10 Sauna Heater.
      b. Stones and Accessories by Manufacturer.
      c. Power: 9.8 kW
   6. Controls: By Manufacturer.
   7. Wood Species:
      a. Wall and Ceiling: Thermo-Spruce.
      b. Bench and Backrest: Thermo-Aspen.
   8. Lighting and Wifi: Combination Light and Wifi Strip by Manufacturer.
      a. Coordinate with building Wifi.
   9. Roof:
      a. By Manufacturer.

C. Barrel Sauna:
   1. Product: Nordica Model EE8G.

2. Assembled Dimensions (exterior): 79" long x 91" long.
3. Assembled Dimensions (interior): 71" long x 87" long.
4. Glazed door by Manufacturer.
    a. Tempered Bronze.(See Section 08 81 00 for requirements for tempered glass)
5. Heating Elements:
    a. Saunum Air L10 Sauna Heater.
    b. Stones and Accessories by Manufacturer.
    c. Power: 9.8 kW.
6. Controls: By Manufacturer.
7. Wood Species:
    a. Wall and Ceiling: Thermo-Spruce.
    b. Bench and Backrest: Thermo-Aspen.
8. Lighting and Wifi: Combination Light and Wifi Strip by Manufacturer.
    a. Coordinate with building Wifi.
9. Roof:
    a. By Manufacturer.

D. Wood Species and Grades: Provide lumber of grades indicated according to DOC PS 20 and the ALSC National Grading Rule provisions of the grading agency indicated.

E. Softwood Plywood: DOC PS 1.

F. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.

G. Fasteners: Stainless steel or hot-dip galvanized.

2.03 ACCESSORIES

A. Signage: Coordinate required signage with building signage provider.

2.04 FABRICATION

A. Sauna body to be delivered complete from fractory, ready to receive hardware, electrical work, vents, 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.

B. No exposed fasteners are allowed in exposed interior surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls, ceilings, and floors for suitable conditions where saunas are to be installed.

B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Condition paneling to average prevailing humidity conditions in installation areas before installation.

3.03 INSTALLATION OF PRECUT SAUNAS

A. Install sauna according to manufacturers' written instructions.

B. Install sauna components level, plumb, true, and straight with no distortions. Shim, as required, with concealed shims. Install level, plumb, and to a true plane to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow.

C. Install interior paneling vertically and anchor to supporting substrate with blind nailing through tongue and groove. Do not use face fastening. Install with fewest joints possible, using full-length pieces.

3.04 CONNECTIONS

A. Connect electrical power service to power distribution system according to requirements specified in Division 16. Connect according to NFPA 70 and local regulations.

3.05 ADJUSTING

A. Adjust sauna door to close securely without binding. Adjust door to operate at room temperature and at sauna operating temperature.

B. Replace sauna components and exposed paneling that are damaged or do not comply with requirements.

END OF SECTION

SECTION 13 24 16
SAUNAS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Precut saunas.
   2. Sauna heaters.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 01 92 00 - Facility Operation and Maintenance.

F. Section 06 10 00 - Rough Carpentry.

G. Section 06 20 00 - Finish Carpentry.

H. Section 07 21 00 - Thermal Insulation.

I. Section 09 30 00 - Tiling.

1.03 REFERENCES

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. PS 1 - Structural Plywood; 2023.

E. PS 20 - American Softwood Lumber Standard; 2025.

F. WCLIB (GR) - WCLB Standard Grading Rules for West Coast & Imported Softwood Lumber No.18; 2024.

G. WWPA G-5 - Western Lumber Grading Rules; 2025.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Source Limitations: Obtain saunas components through one source from a single manufacturer.

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

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. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1, Section - "Project Management and Coordination."

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, sauna heater rated capacities and effective room volumes, and accessories.

B. Shop Drawings: Include dimensioned plans, elevations, sections, and large-scale details.
   1. Show sauna heater dimensions, mounting location, required clearances, and controls.
   2. Include methods of connection for sauna heater, lighting, and controls.

3. Show field measurements, locations and sizes of blocking and reinforcements, and attachments to other work.

C. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

D. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance.

E. Warranty: Special warranty specified in this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store sauna materials and components flat and blocked off the ground.

B. Store saunas in areas where temperature and relative humidity are maintained at occupancy levels.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install saunas until building is enclosed, wet work in spaces is complete and dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify openings and dimensions for precut saunas by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Locate concealed framing, blocking, and reinforcements that support precut saunas by field measurements before being enclosed and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Airmist, Inc.
2. Helo Sauna & Steam.
3. Scandia Manufacturing.
4. Accurate Industries.

2.02 MATERIALS

A. Wood Species and Grades (WD-7A): Provide lumber of grades indicated according to DOC PS 20 and the ALSC National Grading Rule provisions of the grading agency indicated.
1. Western Red Cedar: WCLIB (GR) or WWPA G-5; Clear Heart.
a. Thickness: 11/16”
b. Width: 5 ½”
c. Length: 12 feet.
d. Finish: Vendor to submit sample to Architect for approval.

B. Softwood Plywood: DOC PS 1.

C. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.

D. Fasteners: Stainless steel.

E. Vapor Retarder:
1. See section 09 30 00 - Tiling and drawings for Waterproofing system that functions as a vapor retarder.

2.03 SAUNAS

A. Precut Saunas: Provide manufacturer's standard precut components, and trim; designed for installation over existing framing.

B. Interior Wall and Ceiling Paneling: 1-by-6-inch-nominal (38-by-89-mm-actual), V-joint, tongue-and-groove wood boards of species and grade indicated; sanded smooth; kiln dried to no more than 12 percent moisture content.
   1. Wood Species: Western red cedar (WD-7A).

C. Flooring: See Finish Schedule.

D. Benches: Fabricate from S4S, 2-by-6-inch-nominal (38-by-89-mm-actual) wood, spaced not more than 1/4 inch (7 mm) apart and supported by 2-by-4-inch-nominal (38-by-89-mm-actual), 2-by-6-inch-nominal and 4-by-4-inch-nominal wood framing; of same wood species as interior paneling.

2.04 HEATERS AND CONTROLS

A. Sauna Heater: Manufacturer's standard electric convection unit with stainless-steel elements, stainless-steel interior, stainless-steel exterior, and wire protective top grill. Provide heat-tested, shatter-resistant igneous rocks that are in direct contact with and completely cover heating-unit coils.

B. Basis of Design:
   1. Finnleo, Magma 24.0, Model 1101-240
   2. Or approved equal. See 01 60 00.

C. Requirements:
   1. Capacity:
      a. Sufficient for size of room shown on drawings.
      b. One (1) heater per sauna room if possible. Two (2) heaters to be substituted for large sauna rooms.
   2. Power Supply: 480-V ac, 3-phase.
   3. Mounting: Floor Mounted.
   4. Remote Digital Controls: Subject to compliance with project requirements, provide Saunalogic SL2-C control system. No Substitutions permitted.
      a. Heater switch.
      b. Light switch.
      c. Heat-indicator light.
      d. Adjustable temperature control.
      e. Programmable time and temperature for heater startup and shutdown.
      f. Preset temperature lock.

2.05 ACCESSORIES

A. Provide the following accessories. Provide wood accessories of same wood species as interior paneling, unless otherwise indicated.
   1. Wood guardrail for heater, of dimensions required by listing.
   2. Wood-slat backrest for each bench.
   3. Wood grille for outlet vent.
   4. Thermometer, 4-inch (102-mm) diameter, with chrome casing.

2.06 FABRICATION

A. Fabricate saunas to dimensions, profiles, and details indicated. Sand boards smooth and ease edges to a radius of not less than 1/16 inch (1.6 mm).

B. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, vents, 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.

C. Nail- or screw- and glue bench components together from bottom side.

D. Countersink or conceal all metal fasteners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls, ceilings, and floors for suitable conditions where saunas are to be installed.

B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Condition paneling to average prevailing humidity conditions in installation areas before installation.

3.03 INSTALLATION OF PRECUT SAUNAS

A. Install sauna according to manufacturers' written instructions.

B. Install sauna components level, plumb, true, and straight with no distortions. Shim, as required, with concealed shims. Install level, plumb, and to a true plane to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow.

C. Install interior paneling vertically and anchor to supporting substrate with blind nailing through tongue and groove. Do not use face fastening. Install with fewest joints possible, using full-length pieces.

3.04 CONNECTIONS

A. Connect electrical power service to power distribution system according to requirements specified in Division 16. Connect according to NFPA 70 and local regulations.

3.05 ADJUSTING

A. Adjust sauna door to close securely without binding. Adjust door to operate at room temperature and at sauna operating temperature.

B. Replace sauna components and exposed paneling that are damaged or do not comply with requirements.

END OF SECTION

SECTION 14 00 10
DIVISION 14 TABLE OF CONTENTS

DIVISION 14 – CONVEYING EQUIPMENT

14 08 00 - Commissioning of Conveying Systems

14 21 00 - MRL Electric Traction Elevators

END OF SECTION

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SECTION 14 08 00
COMMISSIONING OF CONVEYING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Passenger Elevators
   2. Wheelchair Lifts

END OF SECTION

SECTION 14 21 50
MRL ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Machine Room-Less Electric Traction Elevators.

B. Products Supplied but Not Installed Under this Section:
   1. Hoist Beam.
   2. Pit Ladder.
   3. Inserts mounted in block walls for rail attachments.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete.

F. Section 04 20 00 - Unit Masonry.

G. Section 05 50 00 - Metal Fabrications.

H. Section 06 10 00 - Rough Carpentry.

I. Section 07 14 50 - Fluid Applied Waterproofing Membrane.

J. Section 09 21 17 - Gypsum Board Shaft Wall Assemblies.

K. Division 23 - Heating, Ventilating, and Air Conditioning.

L. Division 26 - Electrical.

M. Division 27 - Communications.

N. Division 28 - Electronic Safety and Security.

O. Division 31 - Earthwork.

1.03 DEFINITIONS

A. 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.

1.04 REFERENCE STANDARDS

A. ADAAG - Americans With Disabilities Act Accessibility Guidelines; 2010.

B. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.

E. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

K. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

O. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

S. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

T. UL 62 - UL Standard for Safety Flexible Cords and Cables; Current Edition.

U. UL 2556 - UL Standard for Safety Wire and Cable Test Methods; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination of Work:
   1. Elevator Installer is required to coordinate with the installers/providers of all related work, prior to the commencement of any elevator work or related work.
      a. Submit and coordinate Shop Drawings with other trades so that elevator pit, supports, electrical, mechanical and other trades can accomodate the specific type and model of elevator to be installed.
   2. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
   3. Coordinate sequence of elevator installation with other Work to avoid delaying Work.
   4. Coordinate locations and dimensions of other Work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.
   5. Pre Installation Conference:
      a. Hold a Pre-Construction Conference, to include GC, Architect, Mechanical and Electrical Engineers, Elevator Installer, and the Installers of related work, prior to the commencement of work.
      b. Conduct conference according to the requirements of 01 31 00.

1.06 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADAAG Accessibility Guidelines and with ICC A117.1.

C. Car Performance:
   1. Car Speed ± 5% of contract speed under any loading condition or direction of travel.
   2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

D. System Performance:
   1. Horizontal Vibration (maximum): ISO 18738/ISO 8041 system pk-pk 12 mg

2. Jerk Rate (maximum): 1 m/s³
3. Acceleration (maximum): 0.4 m/s²
4. In Car Noise: 55 dB(A) Maximum
5. Leveling Accuracy: ±0.2 inches
6. Starts per hour (maximum): 180

1.07 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product literature for each proposed system.
   1. Cab design, dimensions and layout.
   2. Layout, finishes, and accessories and available options.
   3. Controls, signals and operating system.
   4. Color selection charts for cab and entrances.

C. Shop Drawings:
   1. Clearances and travel of car.
   2. Clear inside hoistway and pit dimensions.
   3. Location and layout of equipment and signals.
   4. Car, guide rails, buffers and other components in hoistway.
   5. Maximum rail bracket spacing.
   6. Maximum loads imposed on building structure.
   7. Hoist beam requirements.
   8. Location and sizes of access doors.
   9. Location and details of hoistway door and frames.
   10. Electrical characteristics and connection requirements.

D. Samples for Selection:
   1. Submit samples of Manufacturer's standard interior cab floor and wall finishes.

E. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

F. Manufacturer's and Installer's qualifications.

G. Operation and maintenance Data:
   1. Provide manufacturer's standard maintenance and operation manual.

H. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

I. Diagnostic Tools:
   1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to Life Time any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed.
      a. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of Life Time. Any diagnostic tool provided to Life Time by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor.
      b. In those cases where diagnostic tools provided to Life Time require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Life Time for a period equal to the term of the maintenance agreement from the date of final acceptance of the competed project. During those intervals in which the Life Time might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to Life Time.

c. The Elevator Contractor shall deliver to Life Time, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor.
d. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

J. Warranty: Special warranty specified in this Section.

K. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.08 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Manufacturer: Minimum of fifteen years' experience in the fabrication, installation and service of elevators of the type and performance of the specified.
1. The manufacturer shall have a documented, on-going quality assurance program.
a. ISO 9001:2000 Manufacturer Certified.

C. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

D. Source Limitations: Obtain elevators through 1 source from single manufacturer.
1. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by single manufacturer.

E. Regulatory Requirements:
1. Comply with the following regulations and standards:
a. ASME A17.1
b. Building Code: ICC As adopted by the AHJ.
c. NFPA 70 National Electrical Code.
d. NFPA 80 Fire Doors and Windows.
e. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
2. Effective peak velocity acceleration (Av) for Project's location is less than 0.10 (seismic risk zones 0 and 1).
3. Project's seismic design category is D unless indicated otherwise in structural Documents.
4. Elevator importance factor is 1.0.

F. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and 407 in ICC A117.1.

G. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible per NFPA 252 or UL 10B.

H. Inspection and testing:
1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Deliver to the Owner upon completion and acceptance of elevator work.

1.09 DELIVERY, STORAGE AND HANDLING

A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.

B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.10 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.11 WARRANTY

A. General Warranty: The elevator warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with, other warranties made by the elevator Contractor under requirements of the Contract Documents.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator Work within specified warranty period.
   1. Warranty Period: 1 year from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 1 year's full maintenance service by skilled employees of 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 same as those used in manufacture and installation of original equipment.
   1. Perform maintenance, including emergency callback service, during normal working hours.
   2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
      a. Response Time: 2 hours or less.

B. Continuing Maintenance Proposal: Provide continuing maintenance proposal from Installer to Owner, in form of standard 1 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.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
   1. Basis of Design: KONE MonoSpace 300® traction elevators by KONE, Inc. (www.kone.com).
   2. ThyssenKrupp Elevator.
   3. Otis Elevator Company.
   4. Or approved equal.

2.02 MACHINE ROOM-LESS ELECTRIC TRACTION ELEVATOR

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:
   1. Elevator Equipment: KONE MonoSpace 300® gearless traction elevator, or equal.
   2. Equipment Control: KCM831, or equal.
   3. Drive: Non-regenerative.
   4. Rated Load: 3,500 lb.
   5. Rated Speed: 100 FPM.
   6. Auxiliary Operations:
      a. Battery Powered Lowering.
   7. Number of Stops: As indicated on Drawings.

8. Travel Distance: As indicated on Drawings.
9. Car Enclosures:
    a. Inside Width: 80 inches (2057 mm) from side wall to side wall.
    b. Inside Depth: 65 inches (1308 mm) from back wall to front wall (return panels).
    c. Overall Cab Height: 96 inches (2438 mm).
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: Plastic laminate, to be selected by Architect from Manufacturer's full range of standard colors.
    g. Ceiling: Suspended Ceiling, satin stainless steel, No. 4 finish with round LED spotlights.
    h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    i. Handrails: 1/2 by 2 inches (13 by 50 mm) rectangular satin-polished stainless steel, No. 4 finish, at sides and rear of car.
    j. Floor prepared to receive finishes shown on drawings. See Finish Plans.
    k. Base, frieze and reveal package No. 4 stainless steel.
10. Hoistway Entrances:
    a. Number of Openings: 1; front.
    b. Door Type: Front Single Speed Opening:
        1) Right Hand Door or Left Hand Door as indicated on Drawings.
    c. Clear Opening Width: 42 inches (1219 mm).
    d. Height: 84 inches (2134 mm).
    e. Type: Single-speed side sliding.
    f. Fire-Protection Rating: As indicated on Drawings.
    g. Frames: Satin stainless steel, No. 4 finish.
    h. Doors: Satin stainless steel, No. 4 finish.
    i. Sills: Aluminum, mill finish.
11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:
    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Provide blanket hooks and 2 complete set(s) of full-height protective blankets.

2.03 SYSTEMS AND COMPONENTS

A. Means of Suspension:
1. Provide Non-combustible means of suspension, meeting the requirements of UL 62, UL 2556 (FT-1) and ASME A17.1. Provide one of the following:
    a. Traditional hoist cables with Wedge Style Shackles or approved means under the code.
    b. Fire rated assembly consisting of metal cables sheathed in non-circular polyurethane jacket.
    c. Other means approved by Architect and AHJ.

B. Hoistway Components:
1. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.
2. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.
3. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

2.04 OPERATIONS SYSTEMS

A. Controller: Provide microcomputer based control system to perform all of the functions.
1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.

2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Controller Location: Locate controller[s] in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

C. Elevator Operation:
1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
2. Zoned Car Parking.
3. Relative System Response Dispatching.

D. Standard Operating Features to include:
1. Full Collective Operation.
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection.
5. Top of Car Inspection Station.

E. Additional Operating Features to include:
1. Elevator Control System for Inspections and Emergency.
   a. Provide devices within controller to run the elevator in inspection operation.
   b. Provide devices on car top to run the elevator in inspection operation.
   c. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
   d. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
   e. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
   f. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
   g. Provide the means for the control to reset elevator earthquake operation.
2. Emergency Communication System: 2-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.
   a. Provide Video communication where required by AHJ.
3. Security Features: In addition to above operational features, provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
   a. Security Camera / Video Capability: Provide wiring terminated on car top in a junction box clearly marked “camera” on the junction box cover located on the opposite corner of the car operating panel. Coordinate with work of Div 28.
4. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators:
   a. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors and shuts down. System includes rechargeable battery and automatic recharging system.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening boltedknock down construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
2. Main landing door & frame finish: ASTM A666/A666M stainless steel panels, factory applied powder coat finish with factory-applied powder coat finish entrance frame.
3. Typical door & frame finish: ASTM A666/A666M stainless steel panels, factory applied powder coat enamel finish with factory-applied powder coat finish entrance frame.

B. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

C. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, 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.
2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
1. Subfloor: Underlayment grade, exterior plywood, 5/8 inch (16 mm) nominal thickness.
2. Floor Finish: Specified in Division 09.
a. Manufacturer's standard LVT finish, color to be selected by Architect from Manufacturer's full range of standard colors.
3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2 inch (13 mm) fire-retardant-treated particleboard with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have flame-spread index of 25 or less, when tested per ASTM E84.
a. Color to be selected by Architect from Manufacturer's full range of standard colors.
5. Fabricate car with recesses and cutouts for signal equipment.
6. Fabricate car door frame integrally with front wall of car.
7. 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 cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
8. Sight Guards: Provide sight guards on car doors.
9. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
10. Handrails: Manufacturer's standard stainless-steel handrails, of shape, metal, and finish indicated.
11. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

C. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.
1. Platform: Platform shall be all steel construction.
2. Steel Cab.

D. Emergency Car Signals:
1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12- volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.

3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

E. Ventilation: Fan.

2.07 DOOR OPERATION

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

2.08 SIGNAL EQUIPMENT

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Brushed Stainless Steel.
   1. Main Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a Brushed Stainless Steel finish.
   2. Additional features of car operating panel shall include:
      a. Car Position Indicator within operating panel.
      b. Elevator Data Plate marked with elevator capacity and car number on car top.
      c. Help buttons with raised markings.
      d. In car stop switch per local code.
      e. Call Cancel Button.

B. Hall Stations:
   1. Provide Hall Stations on wall at location indicated on drawings.
   2. Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.
   3. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
      a. Phase 1 firefighter’s service key switch, with instructions, shall be incorporated into the hall station at the designated level.
   4. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Car Lantern and Chime: A directional lantern shall be provided. Lantern shall be mounted on wall at location indicated on drawings. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish.

2.09 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. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.
   2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
   3. Stainless-Steel Sheet: ASTM A240/A240M, Type 304.
   4. Stainless-Steel Bars: ASTM A276/A276M, Type 304.
   5. Stainless-Steel Tubing: ASTM A554, Grade MT 304.
   6. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.
   7. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS or HGL.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.

B. Prior to start of Work, verify the following:
   1. Hoistway is in accordance with shop drawings, and within Manufacturer's construction tolerances.
   2. Projections greater than 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) are beveled not less than 75 degrees from horizontal.
   3. Landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.
   4. Elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.
   5. Control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.
   6. Installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

C. For the record, prepare written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.

D. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Coordinate installation of blocking and temporary protective closures. See Section 06 10 00.

B. Coordinate installation of anchors, bearing plates, brackets and other related accessories. See Section 05 50 00.

C. Coordinate installation of fireproofing. See Section 07 81 00.

D. Coordinate installation of power, temporary lighting, and temporary power. See Division 26.

E. Coordinate installation of hoistway ventilation. See Division 24.

3.03 INSTALLATION

A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.

B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.

C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.

D. Lubricate operating system components in accordance with manufacturer recommendations.

E. Perform final adjustments, and necessary service prior to substantial completion.

F. Interface with Other Work:
   1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
   2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
      a. Ensure adequate support for entrance attachment points at all landings.
      b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
      c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
      d. Coordinate interface of elevators and fire alarm system.
      e. Coordinate interface of dedicated telephone line.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and Authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

C. Obtain required permits and provide originals to Construction Manager.

3.05 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Prior to substantial completion, instruct Construction Manager on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

D. Check operation of elevator with Owner's personnel present not more than 1 month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION

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SECTION 21 00 00
DIVISION 21 TABLE OF CONTENTS

DIVISION 21 – FIRE SUPPRESSION

21 01 00 - General Requirements for Fire Suppression
21 05 00 - Common Work Results for Fire Suppression
21 05 13 - Common Motor Requirements for Fire Suppression
21 05 29 - Hangers and Supports for Fire Suppression
21 05 53 - Identification for Fire Suppression
21 08 00 - Commissioning of Fire Suppression Systems
21 13 13 - Wet-Pipe Fire Suppression

END OF SECTION

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SECTION 21 01 00
GENERAL REQUIREMENTS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this division of the specifications and accompanying drawings shall be included in one or multiple sub-contracts as coordinated with the General Contractor and shall encompass the following systems:
   1. Certified Fire Protection System.
   2. Refer to the following for additional requirements.
      a. Bidding Requirements, Contract Forms and conditions of the Contract (Division 0)
      b. General Requirements (Division 1)
      c. Geotechnical Investigation (Section 00 31 00)

B. The Scope of Work for each of these systems shall be further defined within the limits of the appropriate section.

C. Sections numbered 21 01 00 thru 21 05 00 shall apply to any and all separate Fire-Suppression contracts as well as those sections and articles of particular concern.

1.02 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in this Specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with the existing conditions and limitations. No extra charges or extension in schedule will be allowed because of the contractor' s misunderstanding as to the amount of work involved or lack of knowledge of any site conditions which may affect the work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum.

1.03 FEES, PERMITS, TAXES AND INSPECTIONS

A. Regular inspections shall be requested by the contractor as required by regulations. Charges for the inspections by regulating agencies of installations or plans and specifications shall be paid by the contractor.

B. All permits, inspections and licenses shall be secured and paid for before actual work is started.

C. The contractor, after completion of work, shall furnish to the Owner a Certificate of Final Inspection and approval from the inspection bureau having jurisdiction.

D. State and Local Sales Tax. The contractor shall include all state and local sales tax in the bid. The contractor shall maintain accurate records of all taxes and furnish such records to the Owner upon request.

1.04 CODES AND STANDARDS

A. Contractor shall comply with all current ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the Contract Documents, the most stringent shall govern. The contractor shall promptly notify the Engineer in writing of such difference.

C. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Contractor shall initiate, maintain, and supervise all safety pre-cautions required for his work including regulations of the Occupational Safety and Health Administration (OSHA).

E. Concrete work. Comply with governing regulations.

1.05 DRAWINGS

A. The drawings are to scale as noted but the contractor shall refer to Architectural and structural Drawings for exact location of partitions, walls, beams, shafts, equipment, etc.

B. Each trade shall avail himself of drawings and specifications of all other trades and make an effort to coordinate his work with all other trades.

C. Each Contractor shall give careful consideration to the work of all other trades and all subsidiary contractors and organize the work so that it will not interfere with work of other trades. Consult the plumbing, sprinkling, heating, ventilating and electrical drawings and specifications for correlating information and the architectural and structural drawings for details, dimensions, foundations, structural elements, pits, etc. The Contractor shall verify all dimensions and conditions, and shall coordinate installation of equipment before fabricating ductwork, piping, etc.

1. Consideration has been given to such condition of limited space in the preparation of the drawings and the locations and dimensions of equipment have been selected accordingly. The contractor shall be warned that in certain instances, space may be limited to the extent that there may be only one arrangement of equipment or facilities which will allow installation of same.

D. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work to eliminate such discrepancies with no change in contract cost.

E. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

F. Where a disagreement exists in the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost, shall be included.

1.06 SYMBOLS AND ABBREVIATIONS

A. Refer to Symbols and Abbreviations listed on drawings. Other symbols are in common usage but if uncertainty exists regarding plan symbols or abbreviations they shall be brought to the attention of the Engineer for clarification.

B. Where the phrase starts “Provide----,” “provide” shall be construed to mean the same as “Furnish and install-----“.

1.07 PRIOR APPROVAL

A. Prior Approvals. The acceptance of materials and equipment shall be based on the following conditions:

1. The contractor shall adhere rigidly to the specifications and shall use exact equipment specified or an approved substitution. Where the words “or equal”, or similar, are used in the specifications, other manufacturers will be considered for acceptance as substitutions; however, such requests must be submitted by a bidding contractor for review prior to bidding. If the contractor desires tentative acceptance of a brand of merchandise not specified, sufficient data shall be submitted to the Engineer for appraisal 240 hours before the time set for bides to be received. If any manufacturer or brands other than those specified, are acceptable to the Engineer, the Engineer will indicate before bids are received; however, such acceptance must still be obtained as described in the following. Equipment which is not specified, or is not approved by addendum will not be considered.

1.08 SHOP DRAWINGS

A. The quantity of Shop Drawings to be submitted shall be as noted in the General Conditions.

B. Shop Drawings shall be submitted by Specification section; all items in each section shall be one (1) bound submittal.

C. Shop Drawings shall be submitted electronically in PDF format. Utilize project document management site to post and manage submittals. Clearly make all submittals with flags or highlights to indicate exact products and options being supplied.

D. Engineer will review initial submittal and one resubmittal. If shop drawings are required to be submitted more than two times dues to Contractor not submitting proper documentation or products, Engineer shall charge Contractor for more time spent reviewing the additional submittals.

E. Acceptance of certain items of equipment, designated by the Engineer, will be based on the manufacturer’s shop drawings and pamphlets which shall be submitted to the Engineer. The contractor shall be prepared to submit samples of equipment or material for appraisal when requested by the Engineer. No materials or equipment shall be installed until the Engineer has given acceptance in writing.

F. The contractor shall supply other trades with approved detail drawings of furnished equipment in the event that equipment will affect the work of other contractors.

1.09 COST BREAKDOWN

A. At the time of submitting the schedule of equipment, the Contractor shall also submit a breakdown of construction costs, either on AIA form G702A or in a manner compatible with proposed pay requests. All items shall be broken down with respect to materials and labor.

1.10 LUBRICATION

A. At the time of installation, and before any equipment is operated for either temporary conditions or performance tests, the Contractor shall properly lubricate all items as necessary according to the manufacturer's recommendations. Where special greases or oils are required, the contractor shall furnish to the Owner, at the time of Owner’s instruction, a one year's supply of such special lubricants.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 RECORD DRAWING NOTES

A. The contractor shall record all changes and deviations from the Contract Drawings. Refer to Division 1 for specific requirements. Include the following as a minimum:
   1. Prepare Record Drawing changes for all fire-suppression work within the building that occurs during the progress of construction. Include such changes as:

a. Addenda
b. Change orders
c. Value engineering

B. The Record Drawings shall be maintained at the job site and be subject to review by the owner or architect/engineer during the construction period. This record keeping requirement shall not be construed as authorization for the contractor to make changes in the layout without definite instructions by the architect/engineer in each case.

C. At the completion of the project, one (1) set of Record Drawings shall be delivered to the Architect/Engineer. This work shall be completed and accepted by the Architect/Engineer before approval of final payment.

3.02 OPERATING AND MAINTENANCE MANUAL(S)

A. The contractor shall collect, gather and assemble manuals, each to contain the installation details, instructions, schematics of actual equipment and operations directions supplied by the manufacturer with equipment for the equipment and materials furnished under Division 21. Provide complete listing of suppliers and distributors where replacement parts or maintenance services are available. Manuals shall be submitted in 3-ring binder format and organized according to specification section. Label cover of manuals with project name; date of completion; and fire-suppression contractor' s name, address, and telephone number. Final acceptance of the work will be withheld until such data has been presented complete to the engineer for transmission to the owner. The manual shall be prepared in time for engineer to review and for contractor to make corrections before owner instruction of operations and maintenance of equipment and systems is scheduled to begin. The manuals may be submitted as a PDF set in lieu of a paper set.

B. Manuals shall include, but not be limited to, the following:
1. Copies of final Shop Drawings
2. Copies of manufacturers’ warranties
3. Copies of all test results
4. Manufacturer’s operating instructions for equipment
5. Manufacturer’s wiring and installation instructions for equipment.
6. Equipment parts list based on each specification section.
7. Local equipment supplies/rep’s names, addresses, and telephone numbers.
8. Equipment manufacturers’ names, addresses, and telephone numbers.
9. Subcontractors’ names, addresses, and telephone numbers

C. Cross out or delete all information shown on Shop Drawings and other literature definitely not applying to this particular project and its equipment installed.

D. Manuals that do not meet the foregoing criteria will be rejected and returned to the contractor for resubmittal.

3.03 FINAL OBSERVATION

A. A final observation of the fire-suppresion systems by the Architect/Engineer will be conducted before the contract can be considered complete. The contractor shall inform the Engineer in writing when the fire-suppression installation is complete and ready for final observation. The Engineer shall visit the project and provide a list of items that need to be corrected or completed to achieve final completion. Should the Engineer attend the project to conduct the final observation and discovers that the work is not sufficiently complete to perform this task, then the contractor shall compensate the Engineer for his time. The contractor shall remain responsible for completing his work and requesting the Engineer to return for a final observation.

3.04 MATERIAL AND WORKMANSHIP

A. All materials and equipment shall be new and best quality, of the type best suited for the purpose intended, conform to the requirements of local and state codes governing the work involved, and be made by nationally recognized and substantially established manufacturers. The type and weight of material shall conform to the requirements of the latest standard specifications of the ASTM for that particular material. The Engineer reserves the right to reject material or workmanship not in accordance with the Specifications, either before or after installation. Contractor will be held responsible for defects in the material and workmanship which may appear during guarantee period after the building has been accepted. Such defects must be repaired or defective material replaced by the contractor at no expense to the owner.

B. No asbestos, hazardous, or PCB containing materials of any type shall be used on this project.

C. The contractor shall be responsible for the proper installation of all systems in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials for a period of 12 months from substantial completion.

3.05 JOB SITE CONDITIONS

A. All construction debris generated by the furnishing and installing of fire-suppression system shall be removed in a timely manner to prevent obstruction of other trades. Cartons, construction debris, piping, etc. shall be removed and the area brought to a "broom clean" finish.

B. At the completion of the work, this Contractor shall remove all rubbish caused by his work from the premises and shall thoroughly clean all equipment piping and ductwork that was installed as part of this contract.

3.06 CLOSEOUT ACTIVITIES

A. Refer to Division 1 specifications for closeout submittals and any demonstration and training requirements.

END OF SECTION

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SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Access Panels.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.
11. Cutting and patching.
12. Cleaning and disinfection.

1.02 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, 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.

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.

1.03 SUBMITTALS

A. Welding certificates.

1.04 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.

PART 2 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 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.

2.02 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 3.2-mm (1/8-inch) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

C. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12.

2.03 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

2.04 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 1725-kPa (250-psig) minimum working pressure at 82 deg C (180 deg F).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 1035- or 2070-kPa (150- or 300-psig) minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Nonconducting materials for field assembly of companion flanges, for 150 psig (1035 kPa) minimum working pressure as required to suit system pressures.
   1. Gasket: Neoprene or phenolic.
   2. Bolt Sleeves: Phenolic or polyethylene.
   3. Washers: Phenolic with steel backing washers.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.05 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Plastic. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.06 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) 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.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.07 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.
   2. Finish: Rough-brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

2.08 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 (34.5-MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.09 ACCESS PANELS

A. Access panels shall be Cesco, or approved, as follows:
   1. Type W 16" x 16" (400x400-mm) min.
   2. Type P or PX 16" x 16" (400x400-mm) min.

3. Type SR 14" x 14" (350x350-mm) min.
4. Type ACRX 24" x 24" (600x600-mm) min.
5. Type AP-FR, 1 1/2 Hour B Label

2.10 FIRESTOPPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Dow Corning: SpecSeal.
   2. 3M Fire Barrier Sealing Systems: Flame Safe Fire Retardant Systems.
   3. Or equal and approved.

B. Submittals.
   1. Indicate each type of condition, listing the U.L. system intended and how it relates to the adjacent construction.
   2. Provide for each type system, a copy of the manufacturers specifications, installation requirements and recommendations.

C. Ratings: Comply with UL 1479 or ASTM E814.
   1. Asbestos free.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 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. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping concealed from view and protected from physical contact by building occupants 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, and coordinate with other services occupying that space.

G. Install piping adjacent to equipment and specialties to allow service and maintenance.

H. Install piping to permit valve servicing.

I. Install piping at indicated slopes.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install piping to allow application of insulation.

M. Select system components with pressure rating equal to or greater than system operating pressure.

N. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

O. Where exposed pipes or ducts pass thru floors, walls or ceilings in finished rooms, they shall be fitted with an approved type metal escutcheon plate (pipe) or metal flange (duct). Escutcheon plates shall be properly sized to fit snug against the pipe or insulation on the inside of the escutcheon and shall be large enough to completely cover the wall or floor penetration opening. Wherever wet conditions are expected on either side of the wall or floor, the penetration shall be sealed with a resilient silicone caulk before the escutcheon is installed. Plates on chromium plated pipe must be finished cast or stamped brass, chromium plated. Flanges for stainless steel or aluminum duct work shall be of a similar material.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

Q. Sleeves located in beams or structural poured walls shall be extra heavy steel pipe.

R. Core drilled holes in walls or floors need not be sleeved. Core drilled hole shall be large enough for pipe and insulation.

S. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened.

T. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
   1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) 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.

U. 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 (25-mm) 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.

V. Wherever pipes pass thru fire rated or acoustically rated walls or floors, the sleeve shall be Pipe Shields, Inc. or equal and approved with thermal barrier, watertight seal and metal shield. Wherever ducts pass thru wall or floors that separate plenum spaces, soffit spaces or as directed in the field, a sheet metal flange barrier shall be installed with foam gasket and caulk.

W. 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 7 Section "Firestopping" for materials.
   1. Clean the surfaces prior to application according to manufacturer’s recommendations, install seal materials in according with U.L. and manufacturers recommendations, and protect the installed materials from necessary traffic. After application, all seals shall be examined by the contractor and shall then be scheduled for inspection by the governing authority before concealing enclosures are applied.

X. Verify final equipment locations for roughing-in.

Y. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 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.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. 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.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

K. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 (DN 65) 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.

3.04 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 mechanical 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.

3.05 CONCRETE BASES

A. Concrete Bases shall be installed by the Concrete Contractor: 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 (100 mm) 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 (450-mm) 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 (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metals" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical 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.

3.08 GROUTING

A. Mix and install grout for mechanical 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.

3.09 ACCESS PANELS

A. Unless otherwise noted on the drawings, each Mechanical Contractor shall furnish wall and ceiling access panels required for all mechanical items. Turn panels over to General Contractor for installation. Locate panels so as to provide maximum accessibility to equipment.

B. In wood stud or steel stud wall construction where access is required on small plumbing item (ie - gas shut off valve) box type construction shall be utilized.

C. This contractor shall group mechanical items according to operation and maintenance and shall provide properly sized access panels for these conditions - maximum of 30x30-inch (800x800-mm) or equivalent area.

D. Where access to mechanical equipment is through "lift-up" ceiling panels, this Contractor shall mark or label panels with buttons, markers or other approved means. Markers shall be paste on 3/8-inch (10-mm) diameter color coded labels. Provide a sample of markers with label of item served on 8-1/2 x 11 (A4) paper mounted under glass in custodians room.

E. Location of all access panels shall be reviewed and approved by Architect. A sample of any button or marker intended shall be submitted to the Architect for review and approval.

3.10 CUTTING AND PATCHING

A. The General Contractor will be required under his contract to leave all chases and openings in new walls, floors, ceilings, partitions, etc., where shown on the drawings or otherwise necessary, to receive mechanical work, but this contractor shall furnish him full information as to locations, dimensions, etc., of such chases and openings, including provision and proper setting of sleeves and other equipment in such time as to cause no delay to work of General Contractor.

B. Should any cutting of new walls, floors, ceilings, partitions, etc., be required for proper installation of the work or apparatus of this Contractor or be made necessary on account of his failure to give General Contractor proper information at the time required, such cutting shall be done at his own expense, restoring the work to its original condition.

C. All cutting and patching done by this Contractor shall be subject to the direction and approval of the Architect. This Contractor shall not endanger the stability of the structure by cutting, digging, or otherwise, and shall not at any time cut or alter work of any other Contractor without the Architect's consent.

D. This Contractor shall provide all cutting required for installing pipe thru precast concrete floor sections. All holes required shall be core drilled of sufficient size for pipe and for insulation.

E. Roof cut and patch shall be performed in a manner to maintain the owners roofing warranty. The contractor shall contact the owner to establish the holder of the guarantee and shall employ a roofing contractor certified to work on the roofing and maintain the guarantee.

3.11 CLEANING AND DISINFECTION

A. Thoroughly clean all parts of the apparatus and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots shall be removed. Repaint or touch up as required to make look like new.

END OF SECTION

SECTION 21 05 13
COMMON MOTOR REQUIREMENTS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 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.

1.02 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

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 1000 m (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.

2.03 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. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. 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.

J. Enclosure Material: Cast iron for motor frame sizes 324T Insert number and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 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 Adjustable Speed 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 H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
   5. Shaft Grounding Kit.

2.05 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. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. 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.

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal-hanger shield inserts.
   4. Fastener systems.
   5. Equipment supports.

B. See Division 5 Section "Metals" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 Section "Wet-Pipe Fire-Suppression" for fire protection piping.

D. See Division 23 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.

1.02 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes 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.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Equipment supports.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 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.

2.02 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. ERICO/Michigan Hanger 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.

2.03 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.

B. Manufacturers:
   1. Anvil International.
   2. ERICO/Michigan Hanger Co.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.04 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (688-kPa) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:
   1. ERICO/Michigan Hanger Co.

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 (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.05 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. Powder-actuated fasteners are strictly prohibited in the pool, pool storage, and pool equipment areas. Stainless steel Hiliti Kwik-Con II mechanical expansion fasteners shall solely be used in these areas, no exceptions. See HANGER AND SUPPORT INSTALLATION below for additional details.
   1. Manufacturers:

a. Hilti, Inc.
b. Powers Fasteners.

C. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, 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. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. Powers Fasteners.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.07 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 (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

3.01 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 (DN 15 to DN 750).
2. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 400), 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 (150 mm) for heavy loads.

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): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   3. C-Clamps (MSS Type 23): For structural shapes.

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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. 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.

B. 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.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners 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.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
   3. Fasteners in pool, pool storage, and pool equipment room shall be ¼” Hilti Kwik-Con II, 410 stainless steel, with 5/16” hex head and internal T-25 Torx recess. No Exceptions

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. 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 (DN 65) 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.

J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. 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.

L. 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.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   5. Pipes NPS 8 (DN 200) 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.

3.03 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.

3.04 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.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 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 (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 21 05 48
SEISMIC CONTROLS FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Restraining braces and cables.

1.02 PERFORMANCE REQUIREMENTS

1.03 SEISMIC-RESTRAINT LOADING:

1. Seismic Design Category as Defined in the IBC: D.
2. Site Class as Defined in the IBC: D.
3. Assigned Occupancy Category of Building as Defined in the IBC: III.
   a. Component Importance Factor: 1.15.
      1) Gas pipe systems.
      2) Plumbing systems associated with discharge from an elevator sump.
      3) Smoke control systems.
      4) Steam piping systems.
      5) Boilers, furnaces and flue systems.
   b. Component Importance Factor: 1.15.
      1) All other mechanical and plumbing systems not described as Component Importance Factor of 1.5 above.
   c. Component Response Modification Factor: Refer the Table near the end of this section.
   d. Component Amplification Factor: Refer the Table near the end of this section.
4. Design Spectral Response Acceleration at Short Periods (0.2 Second):49.7%
5. Design Spectral Response Acceleration at 1-Second Period: 140.7%

1.04 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For seismic-restraint calculations and 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.

C. Welding certificates.

D. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: 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 and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved 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.

1.06 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products of the following:
   1. Cooper B-Line, Inc.; a division of Cooper Industries.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   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. Channel Support System: MFMA-3, 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.

D. Trapeze System:
   1. The hangers must be ASTM A36 all-thread rod.
   2. The threads must be roll formed.
   3. The pipes must be rigidly attached to the hanger rods.
   4. Provisions must be made to avoid impact with adjacent pipe, duct, equipment, or building structure, or to protect the pipe from such impact.

E. Restraint Cables: ASTM A 603 galvanized-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.

F. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

G. 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.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. 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.

1.07 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application.

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.

1.08 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:
   1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).

B. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Comply with requirements in NFPA 13 for fire protection systems.
   3. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
   4. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by the seismic bracing component manufacturer and the authority having jurisdiction.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. 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.

G. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
   5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

1.09 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 15 Section "Domestic Water Piping" for piping flexible connections.

1.10 SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Provide seismic restraints in accordance with the requirements of the Title 24 Building Code for the following:
   1. Mechanical and plumbing systems identified above with a Component Importance Factor of 1.0 and 1.5.

a. Exceptions: The provisions of this section do not cover elevator system piping, gas system piping. The piping considered in the section is assumed to be high-deformability piping. This implies pipes made from ductile materials that are joined by welding, brazing, or groove type couplings, similar to Victualic couplings, where the grooved in the pipe have been roll formed rather than cut. No seismic restraint is required for:
   1) Piping supported by rod hangers.
      (a) Single clevis supported pipe, all of the hangers in the piping run are 12 inches or less in length as measured from the top of pipe to the supporting structure.
      (b) Trapeze supported pipe, all of the hangers in the piping run are 12 inches or less in length as measured from the top of trapeze bar to the supporting structure.
      (c) Hangers must be detailed and constructed in order to avoid significant bending of the hanger and its attachments. Taken to mean must be “non-moment generating” or free swinging
   2) HVAC ducts suspended from hangers that are 21 inches or less in length for the entire run of ductwork as measured from the supporting structure to the top of the trapeze bar supporting the ductwork.
      (a) Hangers must be detailed and constructed in order to avoid significant bending of the hanger and its attachments. Taken to mean must be “non-moment generating” or free swinging

b. Exceptions Seismic Design Category D, E and F: No seismic restraint is required for:
   1) Mechanical and plumbing components which have:
      (a) A Component Importance Factor of 1.0.
      (b) That have flexible connections between the components and all associated duct, piping, conduit.
      (c) Are mounted at 4 feet or less above a floor level.
      (d) Weight 400 lbs or less.
   2) Mechanical and plumbing components which have:
      (a) A Component Importance Factor of 1.0.
      (b) That have flexible connections between the components and all associated duct, piping, conduit.
      (c) Weight 20 lbs or less.
   3) Mechanical and plumbing distribution systems which have:
      (a) A Component Importance Factor of 1.0.
      (b) That have flexible connections between the components and all associated duct, piping, conduit.
      (c) Weight 5 lbs or less.
   4) Mechanical and plumbing components which have a Component Importance Factor of 1.0.
      (a) That have flexible connections between the components and all associated duct, piping, conduit.
      (b) Are mounted at 4 feet or less above a floor level.
      (c) Weight 400 lbs or less.
   5) Single clevis supported pipe which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less.
   6) Single clevis supported pipe which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.

7) Ductwork which have a Component Importance Factor of 1.0 if the cross-sectional area is less than 6 square feet.

c. Exceptions Seismic Design Category D: No seismic restraint is required for:
   1) Trapeze supported piping which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less if:
      (a) The trapeze bar is supported by 3/8-16 UNC, or larger, hanger rods.
      (b) The maximum hanger spacing is 7 feet on center.
      (c) The total weight supported by the trapeze bar is 4 lbs/ft or less.
   2) Trapeze supported piping which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.
      (a) The trapeze bar is supported by 1/2-13 UNC, or larger, hanger rods.
      (b) The maximum hanger spacing is 10 feet on center.
      (c) The total weight supported by the trapeze bar is 25 lbs/ft or less.

d. Exceptions Seismic Design Category E and F: No seismic restraint is required for:
   1) Trapeze supported piping which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less if:
      (a) The trapeze bar is supported by 3/8-16 UNC, or larger, hanger rods.
      (b) The maximum hanger spacing is 7 feet on center.
      (c) The total weight supported by the trapeze bar is 4 lbs/ft or less.
   2) Trapeze supported piping which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.
      (a) The trapeze bar is supported by 1/2-13 UNC, or larger, hanger rods.
      (b) The maximum hanger spacing is 10 feet on center.
      (c) The total weight supported by the trapeze bar is 11 lbs/ft or less.

1.11 COMPONENT AMPLIFICATION AND RESPONSE MODIFICATION FACTORS (BASED UPON ASCE/SEI 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES FOR 20015 IBC TABLE 13.6-1

A.	MECHANICAL COMPONENT	B.	C.
D.	Air-Side HVAC - fans, air handling units, and other mechanical components with sheet metal framing.	E.	F.
G.	Wet-side HVAC - boilers, chillers, and other mechanical components constructed of ductile iron materials	H.	I.
J.	Pumps, compressors, and other vessels not supports on skirts.	K.	L.
M.	Skirt mounted pressure vessels.	N.	O.
P.	Communication, computers, instrumentation and controls.	Q.	R.
S.	Roof-mounted chimney, stacks, cooling towers braced below their center of gravity.	T.	U.
V.	Roof-mounted chimney, stacks, cooling towers braces above their center of gravity.	W.	X.
Y.	Other mechanical components.	Z.	AA.
BB.	Vibration isolated components	CC.	DD.
EE.	Components and systems isolated using neoprene elements and neoprene isolated floors with elastomeric snubbers or resilient perimeter stops.	FF.	GG.

HH.	Spring isolated components and systems and vibration isolated floors closely restrained with elastomeric snubbing devices or resilient perimeter stops.	II.	JJ.
KK.	Internally isolated components or systems.	LL.	MM.
NN.	Suspended vibration isolated equipment including in-line duct devices and suspended internally isolated components	OO.	PP.
QQ.	Distribution Systems	RR.	SS.
TT.	Piping in accordance with ASME B31, this includes in-line components, with joints made by welding or brazing.	UU.	VV.
WW.	Piping in accordance with ASME B31, this includes in-line components, constructed of high or limited deformability materials with joints made by threading, bonding, compression couplings, or grooved couplings.	XX.	YY.
ZZ.	Piping and tubing not in accordance with ASME B31, this includes in-line components, constructed with high deformability materials with joints made by welding or brazing.	AAA.	BBB.
CCC.	Piping and tubing not in accordance with ASME B31, this includes in-line components, constructed of high or limited deformability materials with joints made by threading, bonding, compression couplings, or grooved couplings.	DDD.	EEE.
FFF.	Piping and tubing of low deformability materials, such as cast iron, glass, or non-ductile plastics.	GGG.	HHH.
III.	Ductwork, including in-line components, constructed of high deformability materials with joints made by welding or brazing.	JJJ.	KKK.
LLL.	Ductwork, including in-line components, constructed of high or limited deformability materials, with joints made by means other than welding or brazing.	MMM.	NNN.
OOO.	Ductwork constructed of low deformability materials such as cast iron, glass, or non-ductile plastics.	PPP.	QQQ.

1.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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 post connection 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.
   6. Measure isolator restraint clearance.
   7. Measure isolator deflection.

8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

1.13 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. 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.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

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SECTION 21 05 53
IDENTIFICATION FOR FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Labels for Outdoor Equipment:
   1. Lettering: Stenciled.
   2. Minimum Letter Size: 100 mm (4 inch).

B. Plastic Labels for Indoor Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: White.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. 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 1-1/4 inches (31 mm) high.

PART 3 EXECUTION

3.01 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 encapsulates.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 9 Section " Painting."

B. Locate pipe labels where piping is located 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 20 feet (6 m) along each run.

C. Pipe Label Color Schedule (color schedule must be adjusted to meet local, State and National Codes if different from below):
   1. Fire Riser:
      a. Background Color: White.
      b. Letter Color: Black.

END OF SECTION

SECTION 21 08 00
COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Identification for Fire Suppression
   2. Hangers and Supports for Fire-Suppression
   3. Wet-Pipe Sprinkler Systems

END OF SECTION

SECTION 21 13 13
WET-PIPE FIRE-SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Fire-protection valves.
   3. Fire hose cabinets.
   4. Fire-department connections.
   5. Sprinklers.
   6. Alarm devices.
   7. Pressure gages.

B. The sprinkler plans and this article of the specifications have been developed as a bidding requirements package for a complete fire sprinkler system to be installed in accordance with the NFPA regulations. The contractor shall be required to have design drawings completed by a certified fire sprinkler designer and copies of the hydraulic calculations and plans along with shop drawings of the sprinkler heads, shall be submitted to the State Fire Marshal's office or local authority having jurisdiction for plan review and approval. On or before the time the plans and calculations are submitted to the State for approval, they should be submitted to the engineer for review.

C. If approval is not received by both the engineer and State Fire Marshals office and/or Local Authority having jurisdiction for plan review and approval before sprinkler piping is fabricated. Any change/revision to the piping fabrication is at the cost of the sprinkler contractor. System bid and installed system shall meet all NFPA-13 requirements, including head quantities and locations.

D. The drawings indicate the piping routing and sprinkler head locations for general bidding purposes only. Final pipe locations and sprinkler head layout is the responsibility of the designing contractor. Failure to show heads on the approved shop drawing does not constitute a change order if additional heads are required by the Fire Marshall during construction and inspections (must meet NFPA-13). Additional heads or moving of heads will be made with no additional cost to the contract. The Contractor may propose a different piping scheme, provided it is based on conventional pipe schedule or hydraulic design and the necessary valves and other appurtenances are not deleted.

E. Sprinkler Sub-Contractor shall adhere to other Specification Sections and shall furnish and/or administer each item within proper time limits to avoid project delays. This Contractor shall obtain and submit to Engineer, a Certificate of Approval from the public authority having jurisdiction upon completion of the project.

F. Related Section:
   1. Division 33 Section "Water Utilities" for water-service piping outside the building from source to the point where fire-service piping enters the building.
   2. Division 22 and Division 23 Section “Common Work Results for Plumbing and Common Work Results for HVAC” for joining materials, sleeves, escutcheons, grout, piping joint construction and other common requirements.

1.02 SYSTEM DESCRIPTIONS

A. The work covered by this section of the specifications shall consist of a separate complete and working sprinkling system in this building including double check valve assembly backflow preventer, detector check valves, fire department connections, flow alarms, valves and monitors, drains, inspectors tests, standpipes, heads and all piping from the service riser to the farthest head.

B. The Drawings are general in nature and do not include all offsets, fittings and other items of work necessary for a complete installation.

C. The exterior service piping from the fire main to a point just inside the building foundation or basement wall shall be provided and installed according to Specification Section “Domestic Water Piping” and as shown on the plans.

D. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. 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 in related specification section.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For wet-pipe and dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. 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."

F. Field quality-control reports.

G. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. 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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13, "Installation of Sprinkler Systems."
   2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.02 STEEL PIPE AND FITTINGS

A. Standard Weight (schedule 40), Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Standard Weight (schedule 40), Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Uncoated, Steel Couplings: ASTM A 865, threaded.

F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

K. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Victaulic Company: Model 77.
   2. Pressure Rating: 175 psig (1200-kPa) minimum.
   3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
   4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick.
   1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. 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.

2.04 LISTED FIRE-PROTECTION VALVES

A. General Requirements:
   1. Valves shall be UL listed or FM approved.
   2. Minimum Pressure Rating: 175 psig (1200-kPa).

B. Check Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic.
b. Crane Co.; Crane Valve Group.
c. Lunkenheimer.
d. Powell.

2. Standard: UL 312.
3. Pressure Rating: 250 psig (1725-kPa) minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.
7. Disc and Seat: Renewable.

C. Bronze OS&Y Gate 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: Model B-133.
d. Lunkenheimer.
e. Powell.
2. Standard: UL 262.
3. Pressure Rating: 250 psig (1725-kPa).
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron OS&Y Gate 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: Model G-632.
d. Lunkenheimer.
e. Powell.
2. Standard: UL 262.
3. Pressure Rating: 250 psig (1725-kPa) minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.
6. Post Indicator: As required by local authority.

E. Butterfly 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. Lunkenheimer.
e. Powell.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200-kPa) minimum.
4. Stem: 316 stainless steel.
5. Body: Lug type.
6. Body Material: Cast or ductile iron.

2.05 STANDPIPE VALVES

A. Standpipe Valve.
   1. Type: Angle pattern 2-1/2" standpipe valves
   2. Finish: Polished chrome.
   3. Body: Brass.
   4. Handle: Wheel.
   5. Threads: Hose threads to be compatible with the local fire department.
   6. Rating: UL approved 300 lb., extra heavy angle pattern
   7. Accessories: Cap and chain.
   8. Cabinet: Fully recessed, with flat bevel trim, piano hinge, glass front and polished bronze construction.

2.06 TRIM AND DRAIN VALVES

A. General Requirements:
   1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   2. Minimum Pressure Rating: 175 psig (1200-kPa).

B. 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: Model B-22.
      d. Lunkenheimer.
      e. Powell.
   2. Pressure Rating: 150 psig (1035 kPa) minimum.
   3. Dish: Renewable Teflon.
   4. End Connections: Threaded.

2.07 SPECIALTY VALVES

A. General Requirements:
   1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   2. Minimum Pressure Rating: 175 psig (1200-kPa).
   3. Body Material: Cast or ductile iron.
   4. Size: Same as connected piping.
   5. End Connections: Flanged or grooved.

B. Alarm Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Reliable Automatic Sprinkler Co., Inc.
      b. Tyco Fire & Building Products LP.
      c. Victaulic Company.
      d. Viking Corporation.
   2. Standard: UL 193.
   3. Design: For horizontal or vertical installation.
   4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages,[retarding chamber,] and fill-line attachment with strainer.
   5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AFAC Inc.
      b. Reliable Automatic Sprinkler Co., Inc.
      c. Tyco Fire & Building Products LP.
   2. Standard: UL 1726.
   3. Pressure Rating: 175 psig (1200-kPa) minimum.
   4. Type: Automatic draining, ball check.
   5. Size: NPS 3/4 (DN 20).
   6. End Connections: Threaded.

D. Dry-Pipe Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 60 00 – Product Requirements)::
      a. Reliable Automatic Sprinkler Co., Inc.
      b. Tyco Fire & Building Products LP.
      c. Victaulic Company.
      d. Viking Corporation.
   2. Standard: UL 260
   3. Design: Differential-pressure type.
   4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
   5. Air Compressor:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 60 00 – Product Requirements):
         1) Gast Manufacturing Inc.
         2) General Air Products, Inc,
         3) Viking Corporation.
      b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
      c. Motor Horsepower: Fractional.
      d. Power: 120-V ac, 60 Hz, single phase.

E. Double Check Detector Assembly Backflow Preventer
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Zurn/Wilkins, Model 350ADA with OS&Y gate valves
      b. Or equal and approved.
   2. Locate at the main sprinkler riser as required by the local and state codes.
   3. Locate back flow preventer where it can be tested each year repaired if necessary, as required by code.

F. Reduced-Pressure-Principle Backflow Preventer (RPZ):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Watts Industries, Inc.; Water Products Div.: Model 957-NRS.
   2. Standard: ASSE 1013.
   3. Operation: Continuous-pressure applications.

4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:
    a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
    c. Pressure Gauge: Install pressure gauge on inlet and outlet.

2.08 FIRE HOSE CABINET

A. Class I Valve Cabinet:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Guardian Fire, 2000 series.
    b. Potter Roemer.
    c. Larsen
2. Cabinet type: Suitable for 2-1/2” hose valve.
3. Door Style: Full glass.
4. Recessed Mount Style: Recessed cabinet with trim.
5. Surface Mount Style: Trimless cabinet.
6. Materials:
    a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
    b. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
7. Finish: Manufacturer's standard baked-enamel paint
8. Refer to the drawings for hose cabinet installation type. Provide in recessed or surface mounted as noted on the drawings.

B. Class II Fire Hose Cabinet:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Guardian Fire, 1000 series.
    b. Potter Roemer.
    c. Larsen
2. Cabinet type: Suitable for 100-feet (30m) of 1-1/2-inch (38 mm).
3. Door Style: Full glass.
4. Recessed Mount Style: Recessed cabinet with trim.
5. Surface Mount Style: Trimless cabinet.
6. Materials:
    a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
    b. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
7. Finish: Manufacturer's standard baked-enamel paint
8. Refer to the drawings for hose cabinet installation type. Provide in recessed or surface mounted as noted on the drawings.

C. Class III Fire Hose Cabinet:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Guardian Fire, 1400 series.
b. Potter Roemer.
c. Larsen

2. Cabinet type: Suitable for 100-feet (30m) of 1-1/2-inch (38 mm) and 2-1/2” hose valve.
3. Door Style: Full glass.
4. Recessed Mount Style: Recessed cabinet with trim.
5. Surface Mount Style: Trimless cabinet.
6. Materials:
   a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
   b. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
7. Finish: Manufacturer's standard baked-enamel paint.
8. Refer to the drawings for hose cabinet installation type. Provide in recessed or surface mounted as noted on the drawings.

2.09 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:
1. Manufacturers: Subject to compliance with local requirements, provide products by one of the following:
   a. AFAC Inc.
   b. Elkhart Brass Mfg. Company, Inc.: Model 166
   c. GMR International Equipment Corporation.
   d. Guardian Fire Equipment, Inc.
   e. Potter Roemer.
2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig (1200-kPa) minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Polished chrome plated brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, Polished chrome plated brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to “AUTO SPKR."
14. Finish: Polished chrome plated brass.
15. Outlet Size: NPS 4 (DN 100).

2.10 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Viking Corporation.
2. Tyco-Fire
3. Reliable Sprinkler

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory," listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200-kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:
1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:
1. Chrome plated.
2. Bronze.
3. Painted white.
4. Rough brass.

E. Special Coatings:
1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. 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: Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Plastic, white finish, one piece, flat.

G. Sprinkler Guards:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Century Fire Protection Inc. (No Exceptions); model ACGH2R050 red in color.
   a. Standard: UL 199.
   b. Type: Heavy duty 2 piece wire cage with screw fastening device for attaching to sprinkler head.
3. Sprink Guard LLC (Member’s Activity - No Exceptions); model 201256 white in color.
   a. Standard: UL 199.
   b. Type: Heavy duty 1 piece wire cage with screw fastening device for attaching to ceiling tile.

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Victaulic Company.
   b. Viking Corporation.
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch (250-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).

8. Outlet: NPS 1 (DN 25) drain connection.

C. Water-Flow Indicators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Potter Electric Signal Company.
b. Viking Corporation.
c. Watts Industries (Canada) Inc.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig (1725 kPa).
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Potter Electric Signal Company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.12 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 EXECUTION

3.01 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping inside the building. Comply with requirements for exterior piping in Division 33 Section "Water Utilities."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Division 33 Section "Water Utilities."

3.02 PIPING INSTALLATION

A. 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.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. 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 (DN 8) 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.

M. Fill sprinkler system piping with water.

N. Install standpipe valve as required by code and Local authority. Install in cabinet where noted on the drawings.

O. Drain dry-pipe sprinkler piping.

P. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices and air compressors.

3.03 BELL, FLOW SWITCH AND VALVE MONITOR SWITCHES

A. Install a bell/strobe mounted above the fire department connection, and at each zone of the riser, a flow alarm and a valve monitor switch for the shut-off valves.

B. The flow alarms and monitor switches shall all be provided with four sets of contracts, two normally open and two normally closed. All wiring for these devices shall be by the Sprinkler Contractor.

C. Service entrance point with wiring and devices as required for interlock with the fire sprinkler wiring system of flow alarms, monitor switches and bell they serve.

D. Post under glass in a frame, a small scale plan of the building, showing area covered by each zone.

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
   2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
   3. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
      a. Install air compressor and compressed-air supply piping.

3.06 FIRE HOSE CABINETS

A. Install fire protection cabinets in locations and heights acceptable to authorities having jurisdiction.

3.07 SPRINKLER INSTALLATION

A. Install sprinklers within a 2 1/2" diameter circle in center of tile for pipe penetration, sprinklers not centered will be relocated by using offsets in the piping.

B. Sprinklers located in suspended ceiling shall have ceiling flanges pulled up snugly against the ceiling system.

C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.08 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.09 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section " Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Leak Test: After installation, charge systems 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Start and run excess-pressure pumps.
   6. Coordinate with fire-alarm tests. Operate as required.
   7. Coordinate with fire-pump tests. Operate as required.
   8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.12 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and smaller, shall be one of the following:
   1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
   4. In all pool areas (including pool equipment room) standard-weight, painted galvanized steel pipe with threaded ends; gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 3 (DN 80) and larger, shall be one of the following:
   1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. In all pool areas (including pool equipment room) standard-weight, painted galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   3. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
   6. Concealed piping:
      a. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
      b. Where approved by NFPA regulations and local governing authorities.

E. Dry-pipe sprinkler system, NPS 2 and smaller , shall be one of the following:
   1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight Schedule 30 or thinwall, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
   3. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Schedule 10 piping as allowed per NFPA.

F. Dry-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:
   1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   3. Schedule 10 piping as allowed per NFPA.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Unfinished rooms (no paint on ceiling or bar joist): Rough brass upright sprinklers.
   2. Finished rooms without Ceilings: Chrome upright sprinklers.
   3. Rooms with Suspended Ceilings (Higher then 7’-6”): Semi-recessed, white pendant sprinklers with white escutcheon cups.
   4. Rooms with tile ceiling: Concealed pendant sprinklers with white cover.

a. The white disc cover shall have a maximum thickness of 1/8" and shall be installed flush with the ceiling. The Contractor shall take great care in installing the covers tight to the ceiling.

5. Rooms with Suspended Ceilings (7'-6" or less): Concealed pendant sprinklers with white cover.
   a. The white disc cover shall have a maximum thickness of 1/8" and shall be installed flush with the ceiling. The Contractor shall take great care in installing the covers tight to the ceiling.
6. Open workout area: White Upright sprinklers.
7. Soffits in workout area: Concealed pendant sprinklers with white cover.
   a. The white disc cover shall have a maximum thickness of 1/8" and shall be installed flush with the ceiling. The Contractor shall take great care in installing the covers tight to the ceiling.
8. Wall Mounting: Chrome plated sidewall sprinklers.
   a. Extended throw type where required.
9. Spaces Subject to Freezing: Chrome plated, sidewall, dry sprinklers.
10. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
11. Protection: Sprinkler guards for sprinklers in mechanical rooms, gymnasiums, childcare play, Café storage room, areas and other areas requiring protection.
12. Upright, pendent and sidewall heads located in the pool, pool equipment rooms and locker rooms shall be specifically manufactured with electroless (ENT) nickel finish listed and labeled for extrememly corrossive environments.
13. Saunas and Steam rooms require 286 degree F high temperature heads specifically manufactured with electroless (ENT) nickel finish listed and labeled for extremely corrosive environments.
14. Upright, pendent and sidewall heads located in the exterior bistro areas located within 50 miles of seacoast shall be specifically manufactured with electroless (ENT) nickel finish listed and labeled for extremely corrosive environments.
15. Whirlpool areas and Yoga studios require 204 degree F high temperature heads specifically manufactured with electroless (ENT) nickel finish listed and labeled for extremely corrosive environments.
16. Hot Yoga requires 286 degree F high temperature heads.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Concealed Sprinklers: White sprinkler head with white cup.
   2. Recessed Sprinklers: White sprinkler, with factory-painted white cover plate.
   3. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

C. Provide six extra sprinklers of each style in a wall mounted steel box with a wrench for each size or style.

END OF SECTION

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SECTION 22 00 00
DIVISION 22 TABLE OF CONTENTS

DIVISION 22 – PLUMBING

22 01 00 - General Requirements for Plumbing
22 05 00 - Common Work Results for Plumbing
22 05 13 - Common Motor Requirements for Plumbing
22 05 19 - Meters and Gages for Plumbing
22 05 23 - General-Duty Valves for Plumbing
22 05 29 - Hangers and Supports for Plumbing
22 05 33 - Heat Tracing for Plumbing
22 05 48 - Seismic Controls for Plumbing
22 05 53 - Identification for Plumbing
22 07 00 - Plumbing Insulation
22 08 00 - Commissioning of Plumbing Systems
22 11 16 - Domestic Water Piping
22 11 19 - Domestic Water Piping Specialties
22 11 23 - Domestic Water Pumps
22 13 16 - Sanitary Waste and Vent Piping
22 13 19 - Sanitary Waste Piping Specialties
22 13 23 - Sanitary Waste Interceptors
22 14 13 - Facility Storm Drainage Piping
22 14 20 - Subdrainage
22 14 23 - Storm Drainage Piping Specialties
22 14 29 - Sump Pumps
22 31 00 - Water Softeners
22 33 00 - Electric Domestic Water Heaters
22 35 00 - Domestic Hot Water Heat Exchangers
22 40 00 - Plumbing Fixtures
22 52 13 - Steam Room Generators

END OF SECTION

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SECTION 22 01 00
GENERAL REQUIREMENTS FOR PLUMBING

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this division of the specifications and accompanying drawings shall be included in one or multiple sub-contracts as coordinated with the General Contractor and shall encompass the following systems:
   1. Plumbing, Fixtures & Piping System.
   2. Boiler & Piping Systems.
   3. Lawn Sprinkling System by Others.
   4. Pool Piping Package by Others.
   5. Refer to the following for additional requirements.
      a. Bidding Requirements, Contract Forms and conditions of the Contract (Division 0)
      b. General Requirements (Division 1)
      c. Geotechnical Investigation (Section 02 01 00)

B. The Scope of Work for each of these systems shall be further defined within the limits of the appropriate section.

C. Sections numbered 22 01 00 thru 22 05 00 shall apply to any and all separate Plumbing/Mechanical contracts as well as those sections and articles of particular concern.

1.02 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in this Specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with the existing conditions and limitations. No extra charges or extension in schedule will be allowed because of the contractor' s misunderstanding as to the amount of work involved or lack of knowledge of any site conditions which may affect the work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum.

1.03 FEES, PERMITS, TAXES AND INSPECTIONS

A. Regular inspections shall be requested by the contractor as required by regulations. Charges for the inspections by regulating agencies of installations or plans and specifications shall be paid by the contractor.

B. All permits, inspections and licenses shall be secured and paid for before actual work is started.

C. The contractor, after completion of work, shall furnish to the Owner a Certificate of Final Inspection and approval from the inspection bureau having jurisdiction.

D. State and Local Sales Tax. The Mechanical Contractor shall include all state and local sales tax in the bid. The contractor shall maintain accurate records of all taxes and furnish such records to the Owner upon request.

1.04 CODES AND STANDARDS

A. Contractor shall comply with all current ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the Contract Documents, the most stringent shall govern. The contractor shall promptly notify the Engineer in writing of such difference.

C. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Contractor shall initiate, maintain, and supervise all safety pre-cautions required for his work including regulations of the Occupational Safety and Health Administration (OSHA).

E. Concrete work. Comply with governing regulations.

1.05 DRAWINGS

A. The drawings are to scale as noted but the contractor shall refer to Architectural and structural Drawings for exact location of partitions, walls, beams, shafts, equipment, etc.

B. Each trade shall avail himself of drawings and specifications of all other trades and make an effort to coordinate his work with all other trades.

C. Each Contractor shall give careful consideration to the work of all other trades and all subsidiary contractors and organize the work so that it will not interfere with work of other trades. Consult the plumbing, sprinkling, heating, ventilating and electrical drawings and specifications for correlating information and the architectural and structural drawings for details, dimensions, foundations, structural elements, pits, etc. The Contractor shall verify all dimensions and conditions, and shall coordinate installation of equipment before fabricating ductwork, piping, etc.
   1. Consideration has been given to such condition of limited space in the preparation of the drawings and the locations and dimensions of equipment have been selected accordingly. The contractor shall be warned that in certain instances, space may be limited to the extent that there may be only one arrangement of equipment or facilities which will allow installation of same.

D. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work to eliminate such discrepancies with no change in contract cost.

E. The plumbing system shall be installed substantially as shown on the drawings. The exact position and required offsets of each and every pipe and duct cannot be given by scaling the drawings but shall in every case be placed so as to avoid interference with other work. It is the Contractors responsibility to field measure piping prior to fabrication to avoid conflict with structure, ceiling heights and other trades. Should it be necessary to make changes in the location of piping for its proper installation and operation, or to avoid conflict with other trades, it shall be done by this Contractor without extra charge to the contract.

F. Piping in finished rooms shall be concealed in partitions, furred spaces or suspended ceilings. In unfinished rooms, piping shall be arranged to provide for a maximum of head room.

G. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

H. Where a disagreement exists in the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost, shall be included.

1.06 SYMBOLS AND ABBREVIATIONS

A. Refer to Symbols and Abbreviations listed on drawings. Other symbols are in common usage but if uncertainty exists regarding plan symbols or abbreviations they shall be brought to the attention of the Engineer for clarification.

B. Where the phrase starts “Provide----,” “provide” shall be construed to mean the same as “Furnish and install-----“.

1.07 PRIOR APPROVAL

A. Prior Approvals. The acceptance of materials and equipment shall be based on the following conditions:

1. The contractor shall adhere rigidly to the specifications and shall use exact equipment specified or an approved substitution. Where the words “or equal”, or similar, are used in the specifications, other manufacturers will be considered for acceptance as substitutions; however, such requests must be submitted by a bidding contractor for review prior to bidding. If the contractor desires tentative acceptance of a brand of merchandise not specified, sufficient data shall be submitted to the Engineer for appraisal 240 hours before the time set for bides to be received. If any manufacturer or brands other than those specified, are acceptable to the Engineer, the Engineer will indicate before bids are received; however, such acceptance must still be obtained as described in the following. Equipment which is not specified, or is not approved by addendum will not be considered.

1.08 SHOP DRAWINGS

A. The quantity of Shop Drawings to be submitted shall be as noted in the General Conditions.

B. Shop Drawings shall be submitted by Specification section; all items in each section shall be one (1) bound submittal.

C. Shop Drawings shall be submitted electronically in PDF format. Utilize project document management site to post and manage submittals. Clearly make all submittals with flags or highlights to indicate exact products and options being supplied.

D. Engineer will review initial submittal and one resubmittal. If shop drawings are required to be submitted more than two times dues to Contractor not submitting proper documentation or products, Engineer shall charge Contractor for more time spent reviewing the additional submittals.

E. Acceptance of certain items of equipment, designated by the Engineer, will be based on the manufacturer’s shop drawings and pamphlets which shall be submitted to the Engineer. The contractor shall be prepared to submit samples of equipment or material for appraisal when requested by the Engineer. No materials or equipment shall be installed until the Engineer has given acceptance in writing.

F. The contractor shall supply other trades with approved detail drawings of furnished equipment in the event that equipment will affect the work of other contractors.

1.09 LUBRICATION

A. At the time of installation, and before any equipment is operated for either temporary conditions or performance tests, the Contractor shall properly lubricate all items as necessary according to the manufacturer's recommendations. Where special greases or oils are required, the contractor shall furnish to the Owner, at the time of Owner’s instruction, a one year's supply of such special lubricants.

1.10 TEMPORARY CONDITIONING

A. Refer to Division 1, Article 01 07 1 for basic requirements of temporary facilities and services. Information provided in Division 22 01 00, shall be considered supplemental to, but is not intended to prevail over that stated in Division 1.

B. During the construction of the building, prior to enclosure, each separate contractor shall provide all heat, fuel, and services necessary to protect all of his work and materials against injury from dampness and cold until the building has been enclosed. He shall provide approved temporary heating services, adequate and proper fuel, fires, enclosure, hay, etc. for the work of his trades, and shall have watchmen, as required, constantly in attendance when fires are burning. Salamander heaters in enclosed spaces will not be allowed.

C. The General Contractor shall enclose the building as promptly as possible. The building shall be considered enclosed when the roof is on and doorways, window openings and other openings are closed so as to provide a reasonable retention of heat.
   1. Once the building has been enclosed, the HVAC Contractor and Plumbing Contractor shall temporarily install approximately 3 roof-top units as designated by the Owner including gas pipe and duct work for use as temporary heat. The HVAC Contractor shall maintain protection with appropriate filters at the permanent heating/ventilating equipment until the time of turning the units and system over to the Owner. Air filters in temporary heat units shall be changed every two weeks until the spaces are finished. Filter media shall be installed on return air ducts and also changed every two weeks until the spaces are finished. Mechanical equipment installed prior to completion of the taping and sanding of gypsum walls and ceilings shall utilize the maximum amount of fresh air allowed by the particular unit. Any supply unit used for temporary heat shall have filter changes done as indicated above.

D. Once the equipment is in place and the facility is ready for temporary heating functions, the controls at the 3 units shall be installed in a temporary manner by the HVAC Contractor including furnishing of the stats (non-EMS sensors). The units shall not be connected to the EMS system, but shall instead cycle on the temporary stats until the time of turning the units and system over to the Owner.

E. Approximately 12 weeks prior to turning the facility over to the Owner for occupancy, the HVAC Equipment Supplier / Temperature Supplier shall start up all unit (including the 3 units that have been used for temporary heat) checking for proper operation and shall initiate the control system testing for all required sequences. The one year guarantee period shall commence from that date.

1.11 TRADE CONSIDERATIONS

A. Intra-Contract Boundaries:
   1. For plumbing equipment which is specified under separate sections the Plumbing Contractor will be required to furnish and install the necessary "P" traps, stop valves etc. including rough-in and final connections. Final quantity and rough-in locations for Bistro and Café equipment shall be installed according to Kitchen Equipment Supplier shop drawings.
   2. The Plumbing Contractor shall furnish and install copper p-traps and condensate piping to drip into roof drains for all the roof top units according to manufactures recommendations and local codes.
   3. Flues for gas fired appliances (cloth dryers, etc.) shall be installed by the HVAC Contractor including hook-up to the appliance.
   4. Venting and combustion air to boilers shall be by the HVAC Contractor.

5. Refer to the pool equipment documents for plumbing and ventilation connections required for the pool system. Coordinate during shop drawing preparation with the pool shop drawings to assure final connections of appropriate sizes and locations as required to support the pool system.

B. Electrical Service, Wiring and Connections:
   1. The Electrical Contractor shall provide electrical service to all motors and other mechanical equipment (unless otherwise noted) in conformance with Division 26 of the specifications. The service to packaged equipment shall include power wiring, disconnect switch and the proper connection to the equipment and above items as required. The service to non-packaged equipment shall include power wiring, disconnect switch, motor starter (complete with thermal overload protection and auxiliary dry contacts) and the proper connection to the equipment and above items as required. In cases where mechanical equipment is specified to have single point power connections, and Mechanical Contractor furnishes and installs equipment of multiple connection points, the Mechanical Contractor shall be responsible for additional costs.
   2. All wiring for the control of mechanical motors and equipment shall be furnished complete by the Mechanical Contractor including but not limited to wiring, conduit, devices and installation by a licensed Sub-contractor utilizing Electricians experienced in the types of systems to be installed. All work shall be installed in compliance with NEC regulations and shall be laid out in strict conformance with the wiring diagrams as provided by the manufacture of each section of equipment. It shall be the Mechanical Contractor's responsibility to coordinate all necessary wiring diagrams and shop drawings with the temperature control Sub-contractor for proper lay-out.
   3. Where the Mechanical Contractor extends a circuit provided by the Electrical Contractor, all necessary circuit protection shall be provided by the Mechanical Contractor at points where conductor size is reduced or where the equipment requires special protection. Such circuit protection may be fuses of the cartridge type only. At least one spare fuse of each type must provided to the Owner.
   4. If the Mechanical Contractor proposes to furnish equipment having electrical requirements different from that specified, it shall be the Mechanical Contractor's responsibility to make necessary additions or revisions to the circuit components, and to cover related costs.
   5. Refer to motor schedule shown on electrical drawings for exact items furnished by Electrical Contractor and the number of contacts and items of control which Electrical Contractor will wire.
   6. All factory wiring must be certified by an Independent Testing Lab to comply with N.E.C., ANSI, NFPA, and other regulatory agencies and carry a seal to this effect.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 RECORD DRAWING NOTES

A. The contractor shall record all changes and deviations from the Contract Drawings. Refer to Division 1 for specific requirements. Include the following as a minimum:
   1. Prepare Record Drawing changes for all mechanical work within the building that occurs during the progress of construction. Include such changes as:
      a. Addenda
      b. Change orders
      c. Value engineering

B. The Record Drawings shall be maintained at the job site and be subject to review by the owner or architect/engineer during the construction period. This record keeping requirement shall not be construed as authorization for the contractor to make changes in the layout without definite instructions by the architect/engineer in each case.

C. At the completion of the project, one (1) set of Record Drawings shall be delivered to the Architect/Engineer. This work shall be completed and accepted by the Architect/Engineer before approval of final payment.

3.02 OPERATING AND MAINTENANCE MANUAL(S)

A. The contractor shall collect, gather and assemble manuals, each to contain the installation details, instructions, schematics of actual equipment and operations directions supplied by the manufacturer with equipment for the equipment and materials furnished under Division 23. Provide complete listing of suppliers and distributors where replacement parts or maintenance services are available. Manuals shall be submitted in 3-ring binder format and organized according to specification section. Label cover of manuals with project name; date of completion; and mechanical contractor' s name, address, and telephone number. Final acceptance of the work will be withheld until such data has been presented complete to the engineer for transmission to the owner. The manual shall be prepared in time for engineer to review and for contractor to make corrections before owner instruction of operations and maintenance of equipment and systems is scheduled to begin. The manuals may be submitted as a PDF set in lieu of a paper set.

B. Manuals shall include, but not be limited to, the following:
   1. Copies of final Shop Drawings
   2. Copies of manufacturers’ warranties
   3. Copies of all test results
   4. Copies of all mechanical inspector’s reports
   5. Manufacturer’s operating instructions for equipment
   6. Manufacturer’s wiring and installation instructions for equipment
   7. Equipment parts list based on each specification section
   8. Local equipment supplies/rep’s names, addresses, and telephone numbers
   9. Equipment manufacturers’ names, addresses, and telephone numbers
   10. Subcontractors’ names, addresses, and telephone numbers
   11. Refer to individual sections in Division 22 for additional requirements

C. Cross out or delete all information shown on Shop Drawings and other literature definitely not applying to this particular project and its equipment installed.

D. Manuals that do not meet the foregoing criteria will be rejected and returned to the contractor for resubmittal.

3.03 FINAL OBSERVATION

A. A final observation of the plumbing systems by the Architect/Engineer will be conducted before the contract can be considered complete. The contractor shall inform the Engineer in writing when the plumbing installation is complete and ready for final observation. The Engineer shall visit the project and provide a list of items that need to be corrected or completed to achieve final completion. Should the Engineer attend the project to conduct the final observation and discovers that the work is not sufficiently complete to perform this task, then the contractor shall compensate the Engineer for his time. The contractor shall remain responsible for completing his work and requesting the Engineer to return for a final observation.

3.04 TESTS

A. The contractor shall test the equipment installed under this specification and shall demonstrate its proper operation to the engineer when requested by the engineer.

B. No equipment shall be tested, or operated for any purpose until it has been fully prepared and made ready for normal operation. Damage to equipment occasioned by improper or ill-timed operation or testing shall be made good, at the contractor's expense, before final inspection and acceptance.

3.05 TRAINING

A. Contractor shall furnish, without additional expense to the owner, the services of competent instructions, who will give full instruction in the care, adjustment, and operation and maintenance of parts of the mechanical equipment to the owner's permanent employees who are to have charge of the equipment. Provide a minimum of one man-week (40 hours) of instruction for mechanical equipment. See individual sections for additional training requirements for special systems.

B. Each instructor shall be thoroughly familiar with all parts of the equipment on which instructions are to be given and shall be trained in operating theory as well as in practical operation and maintenance work. Factory trained instructors shall be employed where they are available. Instruction shall be given during regular work week and at a time just prior to the time the equipment is accepted and turned over to the owner for regular operation.

C. All training and operating instructions shall be audio and video recorded by the contractor and the recording media handed over to the owner.

D. Contractor shall submit to the Architect/Engineer, a letter, signed by the owner, stating that the instruction of operating personnel has been completed and is accepted by the owner.

3.06 MATERIAL AND WORKMANSHIP

A. All materials and equipment shall be new and best quality, of the type best suited for the purpose intended, conform to the requirements of local and state codes governing the work involved, and be made by nationally recognized and substantially established manufacturers. The type and weight of material shall conform to the requirements of the latest standard specifications of the ASTM for that particular material. The Engineer reserves the right to reject material or workmanship not in accordance with the Specifications, either before or after installation. Contractor will be held responsible for defects in the material and workmanship which may appear during guarantee period after the building has been accepted. Such defects must be repaired or defective material replaced by the contractor at no expense to the owner.

B. No asbestos, hazardous, or PCB containing materials of any type shall be used on this project.

C. All piping and equipment in finished areas shall be furnished and installed to present a neat and clean appearance. All surfaces except pipe and duct that are to receive paint by General Contractor shall have a factory applied prime coat. All items that are to have finished paint by Mechanical Contractor shall have color selected by Architect/Engineer.

D. The contractor shall be responsible for the proper installation of all systems in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials for a period of 12 months from substantial completion.

3.07 JOB SITE CONDITIONS

A. All construction debris generated by the furnishing and installing of mechanical equipment and systems shall be removed in a timely manner to prevent obstruction of other trades. Cartons, construction debris, piping, etc. shall be removed and the area brought to a "broom clean" finish.

B. Whenever permanent heating equipment is to be utilized for the temporary construction heating, it shall be maintained in a clean condition. The HVAC Contractor shall be responsible to check the unit at start-up and shall install all necessary filters. The General Contractor shall take normal precautions in job site cleanliness and the HVAC Contractor shall periodically inspect the equipment for accumulations of dust and debris. If it is determined that the General Contractor is not maintaining clean conditions throughout the site to the point of possible harm to the equipment, then the HVAC Contractor shall immediately contact the General Contractor and Architect/Engineer for resolution. The permanent heating equipment shall be turned off if resolution cannot be achieved.

C. At the completion of the work, this Contractor shall remove all rubbish caused by his work from the premises and shall thoroughly clean all equipment piping that was installed as part of this contract.

3.08 CLOSEOUT ACTIVITIES

A. Refer to Division 1 specifications for closeout submittals and any demonstration and training requirements.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Sleeves.
   5. Escutcheons.
   6. Floor plates.
   7. Grout.
   8. Temporary water service during construction.
   9. Equipment installation requirements common to equipment sections.
   10. Concrete bases.
   11. Supports and anchorages.

B. Related Sections:
   1. Division 01 Section “Project Management and Coordination” for requirements related to each subcontractor’s responsibility to complete coordination drawings and submit.
   2. Division 01 Section “Closeout Submittals” for requirements related to each sub contractor’s responsibility to submit record drawing to the owner as part of the operation and maintenance data.
   3. Division 23 Section “Common Work Results for HVAC”, 1.5 Coordination.

1.02 DEFINITIONS

A. Refer to General Conditions for additional definitions.

B. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

D. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

F. 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.

1.03 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 Plumbing 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.

PART 2 PRODUCTS

2.01 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.

2.02 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, 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 or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining Plastic Piping:
1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.03 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.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

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: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Plastic Carbon steel Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 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.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 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. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated and rough brass.

2.07 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.08 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.

PART 3 EXECUTION

3.01 TEMPORARY WATER SERVICE

A. Provide a metered, domestic water connection for site use following the installation of the water main.

B. Repair leaks for a water tight installation.

C. Protect water service from freezing conditions using electrical heat tape or other means.

D. Install at least one valved hose connection for use by all personnel on site.

E. Comply with municipal requirements regarding water service and usage.

3.02 MECHANICAL DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.03 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. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.04 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.

I. Plastic 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   5. PVC Nonpressure Piping: Join according to ASTM D 2855.
   6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. 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.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 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.

3.06 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 plumbing 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.

3.07 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 "Cast-in-Place Concrete."

3.08 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.

3.09 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.

3.10 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:
   1. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
      a. Extend sleeves 2 inches above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
   3. Sleeves for Piping Passing through Gypsum-Board Partitions:

a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

4. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
5. Sleeves for Piping Passing through Exterior Concrete Walls:
   a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
   b. Cast-iron wall-pipe sleeves for pipes NPS 6 and larger.
   c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
6. Sleeves for Piping Passing through Interior Concrete Walls:
   a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
   b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.

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 for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.12 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

C. Escutcheons for New Piping:
1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
5. Bare Piping in Equipment Rooms: One piece, cast brass.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.13 FLOOR PLATE INSTALLATION

A. Install floor plates for piping penetrations of equipment-room floors.

B. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.

3.14 GROUTING

A. Mix and install grout for plumbing 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.

END OF SECTION

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SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING

PART 1 GENERAL

1.01 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.

1.02 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

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 1000 m (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.

2.03 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. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. 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.

J. Enclosure Material: Cast iron for motor frame sizes 324T Insert number and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 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 Adjustable Speed 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 H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
   5. Shaft Grounding Kit.

2.05 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. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. 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.

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipe loops and swing connections.
   2. Alignment guides and anchors.

1.02 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.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Warranty: Sample of warranty.
   4. Welding certificate

PART 2 PRODUCTS

2.01 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

3.01 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.

3.02 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one 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

SECTION 22 05 19
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.

1.02 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data

PART 2 PRODUCTS

2.01 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 (Substitutions: See Section 01 6000 – Product Requirements):
      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. Insert manufacturer's name.
   2. Standard: ASME B40.200.
   3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
   4. Case Form: Adjustable angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue 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.

2.02 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, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, 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.

2.03 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.
2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed Open-front, pressure relief Solid-front, pressure relief type(s); cast aluminum or drawn steel; 3-1/2-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.
10. Ring: Metal Brass Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-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

3.01 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 boiler.
   2. Inlets and outlets of each domestic water heat exchanger.
   3. Inlet and outlet of each domestic hot-water storage tank.

I. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. 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.

3.02 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. Thermometer stems shall be of length to match thermowell insertion length.

3.03 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 20 to 200 deg F.

3.04 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   3. PVC/CPVC ball valves.
   4. Iron, single-flange butterfly valves.
   5. Bronze swing check valves.
   6. Iron swing check valves.
   7. Iron swing check valves with closure control.
   8. Bronze gate valves.
   9. Iron gate valves.
   10. Bronze globe valves.
   11. Iron globe valves.
   12. 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.

1.02 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.04 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.
   4. 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. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

1.05 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
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. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO 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: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

1.06 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. 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: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

1.07 PVC/CPVC BALL VALVES

A. True Union 2000 Industrial Type, Full-Port, Schedule 80 Thermoplastic Ball Valves
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Spears Manufacturing Company, or equal.
2. Description:
a. All valves shall be manufactured to ASTM F 1970, constructed of PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447.
b. All valves 1/2-2 shall be pressure rated to 235 PSI, all 2-1/2 valves shall be rated to 150 PSI.
c. Body Design: Two piece
d. Body Material: PVC/CPVC
e. Ends: Threaded
f. Seats: EPDM
g. Stem: PVC/CPVC
h. Ball: PVC/CPVC
i. Port: Full

1.08 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. 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 NBR 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. 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: NBR.
      f. Stem: One- or two-piece stainless steel.
      g. Disc: Aluminum bronze.

C. 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. 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.

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR 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. Spence Strainers International; a division of CIRCOR International, Inc.
o. Sure Flow Equipment Inc.
p. 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: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

1.09 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. Watts Regulator Co.; a division of Watts Water Technologies, 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 125, Bronze Swing Check Valves with Nonmetallic 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.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

1.10 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. Watts Regulator Co.; a division of Watts Water Technologies, 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 125, Iron Swing Check Valves with Nonmetallic-to-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; Stockham Division.
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: Composition.
   g. Seat Ring: Bronze.
   h. Disc Holder: Bronze.
   i. Disc: PTFE or TFE.
   j. Gasket: Asbestos free.

1.11 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.

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:
   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: 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 weight.

1.12 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:
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. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
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: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:
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. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.
2. Description:
a. Standard: MSS SP-80, Type 2.
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: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

1.13 IRON GATE VALVES

A. Class 125, NRS, Iron Gate 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. Flo Fab Inc.
      e. Hammond Valve.
      f. Kitz Corporation.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
      i. Powell Valves.
      j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-70, 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. Disc: Solid wedge.
      g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate 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. Flo Fab Inc.
      e. Hammond Valve.
      f. Kitz Corporation.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
      i. Powell Valves.
      j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-70, 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. Disc: Solid wedge.
      g. Packing and Gasket: Asbestos free.

1.14 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 swing check valves for proper direction of flow and in horizontal position with hinge pin level.

1.15 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.

1.16 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball, butterfly valves.
   2. Throttling Service: ball, or butterfly valves.
   3. 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.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class 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.

1.17 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze or brass with bronze or brass trim.
   3. Bronze Swing Check Valves: Class 125, bronze disc.
   4. Bronze Gate Valves: Class 125, NRS RS.

1.18 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze and brass : May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze with bonze and brass trim.
   3. Bronze Swing Check Valves: bronze disc.

B. Pipe NPS 2-1/2 and Larger:
   1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
   2. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.

3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.

END OF SECTION

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal-hanger shield inserts.
   4. Fastener systems.
   5. Pipe positioning systems.
   6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing 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 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.

PART 2 PRODUCTS

2.01 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. Coatings, where designated:
      a. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
      b. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   3. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 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.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 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 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.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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

3.01 HANGER AND SUPPORT INSTALLATION

A. 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.

B. 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/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. 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.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. 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.

3.02 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 bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 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/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.

3.04 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.

3.05 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 painting Sections.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 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 metal trapeze pipe hangers 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. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. 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.
7. 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.
8. 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.
9. 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.

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.

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. 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.
   8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. 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.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 33
HEAT TRACING FOR PLUMBING

PART 1 GENERAL

1.01 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. Plastic insulated, series resistance.
   2. Self-regulating, parallel resistance.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For electric heating cable.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 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: Three years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. Chromalox, Inc.
   2. Raychem; Tyco Thermal Controls.

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): 140 deg F.

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.

2.02 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.

B. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:
1. Automatic control with manual on, automatic, and standby/reset switch.
2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:
   a. Temperature Span: 34 to 44 deg F.
   b. Adjustable Delay-Off Span: 30 to 90 minutes.
   c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
   d. De-Energize Cables: On detection of a dry surface plus time delay.
3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
4. Minimum 30-A contactor to energize cable or close other contactors.
5. Precipitation sensor shall be freestanding.

2.03 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 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

3.01 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.
2. Temperature Maintenance for Plumbing Drain Lines: Self-regulating, parallel-resistance heating cable.

3.02 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 22 07 .19 "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.

E. Ground equipment according to Section 26 05 .26 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 26 05 .19 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
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.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Remove and replace damaged heat-tracing cables.

END OF SECTION

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SECTION 22 05 48
SEISMIC CONTROLS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Restraining braces and cables.

1.02 PERFORMANCE REQUIREMENTS

1.03 SEISMIC-RESTRAINT LOADING:

1. Seismic Design Category as Defined in the IBC: D.
2. Site Class as Defined in the IBC: D.
3. Assigned Occupancy Category of Building as Defined in the IBC: III.
   a. Component Importance Factor: 1.15.
      1) Gas pipe systems.
      2) Plumbing systems associated with discharge from an elevator sump.
      3) Smoke control systems.
      4) Steam piping systems.
      5) Boilers, furnaces and flue systems.
   b. Component Importance Factor: 1.15.
      1) All other mechanical and plumbing systems not described as Component Importance Factor of 1.5 above.
   c. Component Response Modification Factor: Refer the Table near the end of this section.
   d. Component Amplification Factor: Refer the Table near the end of this section.
4. Design Spectral Response Acceleration at Short Periods (0.2 Second):49.7%
5. Design Spectral Response Acceleration at 1-Second Period: 140.7%

1.04 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For seismic-restraint calculations and 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.

C. Welding certificates.

D. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: 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 and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved 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.

1.06 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products of the following:
   1. Cooper B-Line, Inc.; a division of Cooper Industries.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   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. Channel Support System: MFMA-3, 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.

D. Trapeze System:
   1. The hangers must be ASTM A36 all-thread rod.
   2. The threads must be roll formed.
   3. The pipes must be rigidly attached to the hanger rods.
   4. Provisions must be made to avoid impact with adjacent pipe, duct, equipment, or building structure, or to protect the pipe from such impact.

E. Restraint Cables: ASTM A 603 galvanized-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.

F. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

G. 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.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. 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.

1.07 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application.

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.

1.08 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:
   1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).

B. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Comply with requirements in NFPA 13 for fire protection systems.

3. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
4. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by the seismic bracing component manufacturer and the authority having jurisdiction.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. 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.

G. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

1.09 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 15 Section "Domestic Water Piping" for piping flexible connections.

1.10 SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Provide seismic restraints in accordance with the requirements of the Title 24 Building Code for the following:
1. Mechanical and plumbing systems identified above with a Component Importance Factor of 1.0 and 1.5.
a. Exceptions: The provisions of this section do not cover elevator system piping, gas system piping. The piping considered in the section is assumed to be high-deformability piping. This implies pipes made from ductile materials that are joined by welding, brazing, or groove type couplings, similar to Victualic couplings, where the grooved in the pipe have been roll formed rather than cut. No seismic restraint is required for:
1) Piping supported by rod hangers.
(a) Single clevis supported pipe, all of the hangers in the piping run are 12 inches or less in length as measured from the top of pipe to the supporting structure.

(b) Trapeze supported pipe, all of the hangers in the piping run are 12 inches or less in length as measured from the top of trapeze bar to the supporting structure.
(c) Hangers must be detailed and constructed in order to avoid significant bending of the hanger and its attachments. Taken to mean must be “non-moment generating” or free swinging

2) HVAC ducts suspended from hangers that are 21 inches or less in length for the entire run of ductwork as measured from the supporting structure to the top of the trapeze bar supporting the ductwork.
(a) Hangers must be detailed and constructed in order to avoid significant bending of the hanger and its attachments. Taken to mean must be “non-moment generating” or free swinging

b. Exceptions Seismic Design Category D, E and F: No seismic restraint is required for:
1) Mechanical and plumbing components which have:
(a) A Component Importance Factor of 1.0.
(b) That have flexible connections between the components and all associated duct, piping, conduit.
(c) Are mounted at 4 feet or less above a floor level.
(d) Weight 400 lbs or less.
2) Mechanical and plumbing components which have:
(a) A Component Importance Factor of 1.0.
(b) That have flexible connections between the components and all associated duct, piping, conduit.
(c) Weight 20 lbs or less.
3) Mechanical and plumbing distribution systems which have:
(a) A Component Importance Factor of 1.0.
(b) That have flexible connections between the components and all associated duct, piping, conduit.
(c) Weight 5 lbs or less.
4) Mechanical and plumbing components which have a Component Importance Factor of 1.0.
(a) That have flexible connections between the components and all associated duct, piping, conduit.
(b) Are mounted at 4 feet or less above a floor level.
(c) Weight 400 lbs or less.
5) Single clevis supported pipe which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less.
6) Single clevis supported pipe which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.
7) Ductwork which have a Component Importance Factor of 1.0 if the cross-sectional area is less than 6 square feet.

c. Exceptions Seismic Design Category D: No seismic restraint is required for:
1) Trapeze supported piping which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less if:
(a) The trapeze bar is supported by 3/8-16 UNC, or larger, hanger rods.
(b) The maximum hanger spacing is 7 feet on center.
(c) The total weight supported by the trapeze bar is 4 lbs/ft or less.
2) Trapeze supported piping which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.
(a) The trapeze bar is supported by 1/2-13 UNC, or larger, hanger rods.

(b) The maximum hanger spacing is 10 feet on center.
(c) The total weight supported by the trapeze bar is 25 lbs/ft or less.

d. Exceptions Seismic Design Category E and F: No seismic restraint is required for:
1) Trapeze supported piping which have a Component Importance Factor of 1.5 and for which the nominal size is NPS 1 or less if:
(a) The trapeze bar is supported by 3/8-16 UNC, or larger, hanger rods.
(b) The maximum hanger spacing is 7 feet on center.
(c) The total weight supported by the trapeze bar is 4 lbs/ft or less.
2) Trapeze supported piping which have a Component Importance Factor of 1.0 and for which the nominal size is NPS 3 or less.
(a) The trapeze bar is supported by 1/2-13 UNC, or larger, hanger rods.
(b) The maximum hanger spacing is 10 feet on center.
(c) The total weight supported by the trapeze bar is 11 lbs/ft or less.

1.11 COMPONENT AMPLIFICATION AND RESPONSE MODIFICATION FACTORS (BASED UPON ASCE/SEI 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES FOR 20015 IBC TABLE 13.6-1

A.	MECHANICAL COMPONENT	B.	C.
D.	Air-Side HVAC - fans, air handling units, and other mechanical components with sheet metal framing.	E.	F.
G.	Wet-side HVAC - boilers, chillers, and other mechanical components constructed of ductile iron materials	H.	I.
J.	Pumps, compressors, and other vessels not supports on skirts.	K.	L.
M.	Skirt mounted pressure vessels.	N.	O.
P.	Communication, computers, instrumentation and controls.	Q.	R.
S.	Roof-mounted chimney, stacks, cooling towers braced below their center of gravity.	T.	U.
V.	Roof-mounted chimney, stacks, cooling towers braces above their center of gravity.	W.	X.
Y.	Other mechanical components.	Z.	AA.
BB.	Vibration isolated components	CC.	DD.
EE.	Components and systems isolated using neoprene elements and neoprene isolated floors with elastomeric snubbers or resilient perimeter stops.	FF.	GG.
HH.	Spring isolated components and systems and vibration isolated floors closely restrained with elastomeric snubbing devices or resilient perimeter stops.	II.	JJ.
KK.	Internally isolated components or systems.	LL.	MM.
NN.	Suspended vibration isolated equipment including in-line duct devices and suspended internally isolated components	OO.	PP.
QQ.	Distribution Systems	RR.	SS.
TT.	Piping in accordance with ASME B31, this includes in-line components, with joints made by welding or brazing.	UU.	VV.
WW.	Piping in accordance with ASME B31, this includes in-line components, constructed of high or limited deformability materials with joints made by threading, bonding, compression couplings, or grooved	XX.	YY.

	couplings.		
ZZ.	Piping and tubing not in accordance with ASME B31, this includes in-line components, constructed with high deformability materials with joints made by welding or brazing.	AAA.	BBB.
CCC.	Piping and tubing not in accordance with ASME B31, this includes in-line components, constructed of high or limited deformability materials with joints made by threading, bonding, compression couplings, or grooved couplings.	DDD.	EEE.
FFF.	Piping and tubing of low deformability materials, such as cast iron, glass, or non-ductile plastics.	GGG.	HHH.
III.	Ductwork, including in-line components, constructed of high deformability materials with joints made by welding or brazing.	JJJ.	KKK.
LLL.	Ductwork, including in-line components, constructed of high or limited deformability materials, with joints made by means other than welding or brazing.	MMM.	NNN.
OOO.	Ductwork constructed of low deformability materials such as cast iron, glass, or non-ductile plastics.	PPP.	QQQ.

1.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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 post connection 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.
   6. Measure isolator restraint clearance.
   7. Measure isolator deflection.
   8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

1.13 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. 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.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Labels for Outdoor Equipment:
   1. Lettering: Stenciled.
   2. Minimum Letter Size: 100 mm (4 inch).

B. Plastic Labels for Indoor Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: White.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. 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 1-1/4 inches (31 mm) high.

PART 3 EXECUTION

3.01 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 encapsulates.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 9 Section " Finishes."

B. Locate pipe labels where piping is located 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 20 feet (6 m) along each run.

C. Pipe Label Color Schedule (color schedule must be adjusted to meet local, State and National Codes if different from below):
   1. Domestic Water Piping (Cold, Hot, Recirculating Hot, Non-Potable, Irrigation): By Plumbing Contractor.
      a. Background Color: White.
      b. Letter Color: Black.
   2. Natural Gas Piping: By Plumbing Contractor.
      a. Background Color: White.
      b. Letter Color: Black.
   3. Heating Water Piping: By Heating/Boiler Contractor.
      a. Background Color: Yellow.
      b. Letter Color: Black.
   4. Core Loop Water Piping: By Heating/Boiler Contractor.
      a. Background Color: Yellow.
      b. Letter Color: Black.
   5. Low-Pressure Steam Piping (steam rooms in locker rooms): By Heating/Boiler Contractor.
      a. Background Color: White.
      b. Letter Color: Black.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Flexible elastomeric.
      b. Mineral fiber.
   2. Fire-rated insulation systems.
   3. Insulating cements.
   4. Adhesives.
   5. Sealants.
   6. Factory-applied jackets.
   7. Field-applied jackets.
   8. Tapes.
   9. Securements.

B. Related Sections:
   1. Division 22 Section "Domestic Water Piping" for piping.
   2. Division 22 Section "Storm Drainage Piping" for piping.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
   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, flanges, valves, and specialties for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.
   5. Detail field application for each equipment type.

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 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: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and 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.

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.; Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Duct Wrap.

H. 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 Pipe Insulation.
   2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article. Nominal density is 4 lb/cu. ft. (64-kg/cu. m) or more.
   3. Molded closed cell polyethylene foam insulation is not an approved equal.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied 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 3 lb/cu. ft. (48-kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) 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.

2.02 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by a NRTL acceptable to authority having jurisdiction.
   1. Products: Subject to compliance with requirements, provide the following:
      a. 3M; Fire Barrier Wrap Products, Wrap 15A.

2.03 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Insulco, Division of MFS, Inc.; SmoothKote.
   b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.

2.04 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 LCC; 520 Adhesive.
   2. For indoor applications, use adhesive that has 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 Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 SEALANTS

A. Joint Sealants:

B. FSK and Metal Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-76-8.
      b. Foster Products Corporation, H. B. Fuller Company; 95-44.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Vimasco Corporation; 750.
   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 (Minus 40 to plus 121 deg C).
   5. Color: Aluminum.
   6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Products, Division of ITW; 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 (Minus 40 to plus 121 deg C).
   5. Color: White.
   6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.06 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
      a. Products: Subject to compliance with requirements, provide the following:
         1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.07 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 the following:
      a. Johns Manville; Zeston.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.
   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, and mechanical joints.
   5. Factory-fabricated tank heads and tank side panels.

2.08 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches (75 mm).
   3. Thickness: 11.5 mils (0.29 mm).
   4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
      b. Compac Corp.; 110 and 111.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
      d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
   2. Width: 3 inches (75 mm).
   3. Thickness: 6.5 mils (0.16 mm).
   4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.
2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.09 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 2 inches (50 mm) o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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 (100 mm) 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.

3.03 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 (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. 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 (50 mm).
1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

3.04 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

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 50 percent coverage of tank and vessel surfaces.
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. 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 (75 mm) from insulation end joints, and 16 inches (400 mm) 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.
4. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
5. 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 (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) 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 (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.

6. Stagger joints between insulation layers at least 3 inches (75 mm).
7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for 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.

3.05 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. Zeston plenum rated covers over 1 pound density microlite blanket and 18 gauge galvanized wire at all fittings.
2. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.

9. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, 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.
10. 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, vessels, and equipment. 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.

3.06 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

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.

3.07 MINERAL-FIBER INSULATION INSTALLATION

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 (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but 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 (25 mm), 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.

E. 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 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 (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
      b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) 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 (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) 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 (10 deg C) at 18-foot (5.5-m) 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 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) 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- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.08 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 Division 7 Section "Through-Penetration Firestop Systems."

D. Insulation shall be installed according to manufactures instructions, including banding, perimeter and longitudinal overlaps, and complete access panel insulation.

E. The Contractor must submit to the City or governing agency the proposed insulation system to be used, including all listings with code compliance and installation instructions.

3.09 FINISHES

A. Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 Paints and Coatings Sections.
   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.

3.10 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Heat-Exchanger (Water-to-Water shell and tube for Pool Water Heating Service) Insulation: Mineral-Fiber Pipe and Tank with ASJ: 2 inches (50 mm) thick.

D. Air Separator (boiler system) Insulation: Mineral-Fiber Pipe and Tank with ASJ: 2 inches (50 mm) thick.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Insulation thickness must match values below at minimum and be increased to code required values if different than that stated.

B. Domestic Cold Water (1-1/4” dia. and smaller): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1/2 inch (13-mm) thick.

C. Domestic Cold Water (1-1/2” dia. and larger): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1 inch (13-mm) thick.

D. Domestic Hot Water (1-1/4” dia. and smaller): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1 inch (25-mm) thick.

E. Domestic Hot Water (1-1/2” dia. and larger): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1-1/2 inch (38-mm) thick.

F. Domestic Recirculated Hot Water (1-1/4” dia. and smaller): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1 inch (25-mm) thick.

G. Domestic Recirculated Hot Water (1-1/2” dia. and larger): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1-1/2 inch (38-mm) thick.

H. Stormwater (roof drain body and horizontal piping only): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1/2 inch (13-mm) thick.

I. Roof Drain: Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1/2 inch (13-mm) thick.

J. Steamer Discharge Piping: Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 2-1/2 inch (38-mm) thick.

K. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below (1-1/4” dia. and smaller): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1-1/2 inch (25-mm) thick.

L. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below (1-1/2” dia. and larger): Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 2 inch (38-mm) thick.

M. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1/2 inch (13-mm) thick.

N. Cooling Coil Condensate: Insulation shall be the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1/2 inch (13-mm) thick.

O. Vent Piping: The first 15' from the roof penetration shall be insulated with the following:
   1. Mineral-Fiber, Preformed Pipe Insulation with ASJ, Type I: 1/2 inch (13-mm) thick.

3.13 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. Piping (All fittings):
   1. PVC: 30 mils (0.8-mm) thick.

END OF SECTION

SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Meters and Gauges for Plumbing
   2. General-Duty Valves for Plumbing
   3. Hangers and Supports for Plumbing
   4. Identification for Plumbing
   5. Plumbing Insulation
   6. Domestic Water Piping
   7. Domestic Water Piping Specialties
   8. Domestic Water Pumps
   9. Facility Natural-Gas Piping
   10. Sump Pumps
   11. Water Softeners
   12. Gas-Fired Domestic Water Heaters
   13. Plumbing Fixtures
   14. Steam Room Generators
   15. Oil and Grease Interceptors

END OF SECTION

SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Related Sections and Documents:
   1. Section 312000 Earth Moving.
   2. Salt Lake City Public Utility Standards and Specifications.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Pipe Materials, Valves, Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

   1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
   3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.5 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket and spigot end.

2.2 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.3 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve

matching size and type of pipe material being tapped and with recessed flange for branch valve.

c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.4 WATER METERS

A. Water meters will be furnished by utility company.

2.5 CONCRETE METER VAULT

A. Description: Precast, reinforced-concrete vault, per APWA Plan 505.

2.6 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.
b. Pressure Rating: 150 psig minimum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration.

G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

H. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

3.8 WATER METER BOX INSTALLATION

A. Install water meter boxes flush with surface.

3.9 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water-distribution piping to existing water main using tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.11 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Complete tests in accordance with Provo City requirements.

B. Prepare reports of testing activities.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

3.13 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Specialty valves.
   3. Transition fittings
   4. Dielectric fittings
   5. Flexible connectors.
   6. Water meter.

B. Related Section:
   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.

1.02 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14/ANSI 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

D. All piping shall be tested for working pressure of 150 psi minimum and temperature of 210-degree Fahrenheit, as required by Minnesota code.

E. Water service line must be installed at least 10 feet horizontally from any manhole, catch basin, or any other potential source of contamination (see Minnesota Rules, part 4715 1710, subpart 3).

PART 2 PRODUCTS

2.01 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.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ANSI H23.1, ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.

B. Soft Copper Tube: ANSI H23.1, ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ANSI H23.1, ANSI B16.22, ANSI B1618, ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASTM B62, 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. Copper Pressure-Seal-Joint Fittings:
   1. Fittings for NPS 2 (DN 50) and Smaller: ASME B16.51, wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   2. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): NSF/ANSI 372, cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:
   1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
   2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.03 DUCTILE-IRON PIPE AND FITTINGS WATER SERVICE THROUGH BUILDING FLOOR/WALL ONLY

A. Mechanical-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   2. ANSI A21.15 compliant.
   3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. ANSI A21.15 compliant.
   3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.
   2. ANSI A21.15 compliant.
   3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.04 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:
   1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
   2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:
   1. ASME B16.39, Class 150.
   2. Hexagonal-stock body.
   3. Ball-and-socket, metal-to-metal, bronze seating surface.
   4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

2.05 ABS ACRYLONITILE BUTADIENE-STYRENE WATER SERVICE THROUGH BUILDING FLOOR/WALL ONLY

A. ABS piping: ANSI 72.3, ASTM D 2282, NSF14, CS254.

2.06 PVC PIPE AND FITTINGS WATER SERVICE THROUGH BUILDING FLOOR/WALL ONLY

A. PVC Pipe (Schedule 80): ANSI 72.2, ASTM D 1785, ASTM D 2241.

B. PVC Socket Fittings: ASTM D 2467 for Schedule 80.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

D. PVC piping and fittings shall also be compliant with ANSI B72.2, ASTM D2241, ASTM D1785, NSF14, CS256, CSA-B137.3

2.07 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) 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.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493 and ASTM D2846.
   1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. 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).
   3. Solvent cement and adhesive primer 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."

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.08 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. CPVC Union Ball Valves:
   1. Description:
      a. Standard: MSS SP-122.
      b. Pressure Rating: 125 psig at 73 deg F.
      c. Body Material: CPVC.
      d. Body Design: Union type.
      e. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
      f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or Flanged.
      g. Ball: CPVC; full port.
      h. Seals: PTFE or EPDM-rubber O-rings.
      i. Handle: Tee shaped.

D. CPVC Ball Check Valves:

1. Description:
    a. Pressure Rating: 125 psig at 73 deg F.
    b. Body Material: CPVC.
    c. Body Design: Union-type ball check.
    d. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
    e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or Flanged.
    f. Ball: CPVC.
    g. Seals: EPDM- or FKM-rubber O-rings.

E. CPVC Gate Valves:
1. Description:
    a. Pressure Rating: 125 psig at 73 deg F.
    b. Body Material: CPVC.
    c. Body Design: Nonrising stem.
    d. End Connections for Valves NPS 2 and Smaller: Socket.
    e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or Flanged.
    f. Gate and Stem: Plastic.
    g. Seals: EPDM rubber.
    h. Handle: Wheel.

F. PEX Ball Valves:
1. Description:
    a. Pressure Rating: 160 psig at 73 deg F.
    b. Body Material: C69300 Lead-free Brass
    c. Body Design: Two-piece
    d. End Connections for Valves NPS 2 and Smaller: ASTM F1960
    e. End Connections for Valves NPS 2-1/2 to NPS 4: Threaded, Sweat, or Flanged.
    f. Seals: EPDM
    g. Handle: Lever

2.09 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. Plastic-to-Metal Transition Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 6000 – Product Requirements):
    a. Charlotte Pipe and Foundry Company.
    b. Harvel Plastics, Inc.
    c. Spears Manufacturing Company.
    d. Uponor
2. Description:
    a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 6000 – Product Requirements):

a. Colonial Engineering, Inc.
b. NIBCO Inc.
c. Spears Manufacturing Company.

2. Description:
a. CPVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Description:
a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:
a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:
1. Description:
a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

2.11 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.12 WATER METERS

A. Water meter shall be provided per city/state requirements.

PART 3 EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.02 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

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 in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. 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.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping adjacent to equipment and specialties to allow service and maintenance.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than 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 from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

R. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

S. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

W. Fire stopping shall be provided to both be compatible with the pipe material used and meet the requirements of ASTM E 814 or ULC S115, “Fire Tests of Through-Penetration Firestops”. Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.

X. Domestic water piping shall not be installed near outdoor or combustion air intakes that are open to the space that may cause freezing of the domestic water piping.

3.03 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: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: 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. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. 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.

I. Joint Construction for Solvent-Cemented Plastic Piping: 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. Apply primer.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J. Joints for PEX Piping: Join according to ASTM F 1960 and manufacturer’s instructions.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 FUSION WELDING OF JOINTS

A. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting type. All fusion-well joints shall be made in accordance with the pipe and fitting manufacturer’s specifications and product standards.

B. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

C. Prior to joining, the pipe and fittings shall be prepared in accordance with F 2389 and the manufacturer’s specifications.

D. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer’s specifications.

3.05 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.06 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.07 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 couplings or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.08 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.09 WATER METER INSTALLATION

A. Rough-in domestic and irrigation water piping and install water meters according to utility company's requirements. This contractor shall coordinate with local city or utility and provide meters as required and is responsible for all associated costs.

B. Install water meters according to AWWA M6, utility company's requirements.

C. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   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.
   3. 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 and/or as indicated in local code whatever is LESS:
   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/2: 72 inches with 3/8-inch rod.
   3. 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.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters and/or as indicated in local code whatever is LESS:
   1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
   2. NPS 1-1/2: 108 inches with 3/8-inch rod.
   3. NPS 2: 10 feet with 3/8-inch rod.
   4. NPS 2-1/2: 11 feet with 1/2-inch rod.
   5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
   6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
   7. NPS 6: 12 feet with 3/4-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

K. Install vinyl-coated hangers for PP-R piping with the following maximum horizontal spacing and minimum rod diameters and/or as indicated in local code whatever is LESS:
1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

L. Install hangers for vertical PP-R piping every 48 inches and/or as indicated in local code whatever is LESS.

M. Install hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 32 inches with 3/8-inch rod.
2. NPS 1-1/4 (DN 32) and Larger: 48 inches with 3/8-inch rod.
3. Note: When installed with a continuous support such as PEX-a Pipe Support:
4. NPS 3/4 (DN 20) and Smaller: 6 feet with 3/8-inch rod.
5. NPS 1 (DN 25) and Larger: 8 feet with 3/8-inch rod.

N. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.11 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 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
4. 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.

3.12 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.13 FIELD QUALITY CONTROL

A. Perform 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 final inspection for authorities having jurisdiction to observe tests specified 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 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.

3.14 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.

3.15 CLEANING

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. 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 (50 mg/L) 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 (200 mg/L) 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.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

3.16 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
   1. Soft copper tube without joints, ABS and PVC.
   2. PEX tube, ASTM F877 or ASTM F1960 connections.

D. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be the following:
   1. Push-on-joint, ductile-iron pipe; standard- or compact- pattern push-on-joint fittings; and gasketed joints.

E. Aboveground domestic water piping, NPS 2-1/2 and smaller, shall be the following:
   1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and brazed or soldered joints.
   2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
   4. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 and NPS 2 CPVC pipe with CPVC socket fittings may be used instead of tubing.
   5. Polypropylene tube and fittings.
   6. PEX-a tube, NPS 3 and smaller; fittings for PEX tube; and ASTM F1960 joints.

F. Aboveground domestic water piping, NPS 3 to NPS 4, shall be the following:
   1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and brazed or soldered joints.
   2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
4. Polypropylene tube and fittings.
5. PEX-a tube, NPS 3 and smaller, fittings for PEX tube; and ASTM F1960 joints.

G. Aboveground domestic water piping, NPS 5 and larger, shall be the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and brazed or soldered joints.
2. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.

H. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to (DN 300), shall be one of the following:
1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

END OF SECTION

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 CONDITIONS OF THE CONTRACT

A. Plumbing Contractor is responsible to furnish, install and execute all of the following work as required, specified and/or indicated on plan unless noted to be performed by another contractor.

1.02 SUMMARY

A. This Section includes the following:
   1. Plumbing Fixtures.

B. The Owner has chosen the fixtures listed below as prototype for all buildings. No substitutions will be considered.

1.03 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.05 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 Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

C. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 PRODUCTS

A. F-1 Lavatory, ADA:
   1. Kohler K-2882, ADA vitreous china lavatory for under counter mounting with under deck clamp assembly, overflow, basin size of 19-13/16"x15-5/8". Color shall be Biscuit. All hardware and trim for fixture to be furnished and installed by the Plumbing Contractor.
   2. Symmons #SLS-3510-0.5 lavatory faucet with washerless ceramic disc cartridge, polished chrome finish, deck plate, lever handle, 0.5 GPM aerator, no popup drain and open grid strainer.
   3. McGuire #155A polished chrome cast brass 1-1/4" tail piece, or approved equal.
   4. McGuire #8902C 1-1/4" cast brass P-trap with cleanout plug and polished chrome finish, or approved equal.
   5. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.

6. Plumberex ‘Pro Extreme’ flexible white molded, closed cell PVC insulated waste and water supply piping covers complete with internal ribs, snap-lock fastening system and weep hole in base of trap. Supply valve cover shall be hinged for access, or approved equal.

B. F-1B Lavatory, ADA:
1. Kohler K-2882, ADA vitreous china lavatory for under counter mounting with under deck clamp assembly, overflow, basin size of 19-13/16"x15-5/8". Color shall be Biscuit. All hardware and trim for fixture to be furnished and installed by the Plumbing Contractor.
2. Sloan #EAF-250, battery powered, deck-mounted mid-body, lavatory sensor faucet with infrared sensor, 30 second time out, 0.5 gpm laminar flow, open grid strainer, and polished chrome finish.
3. McGuire #155A polished chrome cast brass 1-1/4" tail piece, or approved equal.
4. McGuire #8902C 1-1/4" cast brass P-trap with cleanout plug and polished chrome finish, or approved equal.
5. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.
6. Plumberex ‘Pro Extreme’ flexible white molded, closed cell PVC insulated waste and water supply piping covers complete with internal ribs, snap-lock fastening system and weep hole in base of trap. Supply valve cover shall be hinged for access, or approved equal.

C. F-2 Drinking Fountain, ADA:
1. Most Dependable Fountains Model#480EZWM ADA compliant, single height textured sandstone wall mounted drinking fountain, domed grid strainer, 1-1/4" tail piece, and push button bubbler. Complies with NSF-61 lead free act.
2. Provide (2) Drinking Fountains – (1) to be mounted at ADA height 32” AFF and (1) Non-ADA height 40”. The drinking fountains should be 18” apart.
3. McGuire #8902C 1-1/4" cast brass P-trap with cleanout plug and polished chrome finish, or approved equal.
4. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.

D. F-3 Water Closet, ADA:
1. Kohler #K-96057-96, ADA vitreous china floor set flush valve water closet with elongated bowl, siphon jet flushing, 2-1/4" passage way, 1-1/2" top spud. 18” fixture height. Color shall be Biscuit.
2. Sloan #8111-1.6G2 Optima Plus, battery powered, sensor operated, water closet flush valve, 1.6 gpf flush with chrome plating, metal cover, back check angle stop, top spud, adjustable tail piece, and vacuum breaker.
3. Kohler #K-4731-SC-96 solid plastic Biscuit color extra heavy duty toilet seat without cover, with open front and self sustaining check hinge.

E. F-4 Water Closet:
1. Kohler #K-96053-96 vitreous china floor set flush valve water closet with elongated bowl, siphon jet flushing, 2-1/8" passage way, 1-1/2" top spud. 15” fixture height. Color shall be Biscuit
2. Sloan #8111-1.6 G2 Optima Plus, battery powered, sensor operated, water closet flush valve, 1.6 gpf flush with chrome plating, metal cover, back check angle stop, top spud, adjustable tail piece, and vacuum breaker.
3. Kohler #K-4731-SC-96 solid plastic Biscuit color extra heavy duty toilet seat without cover, with open front and self sustaining check hinge.

F. F-6 Urinal:

1. Kohler #K-4991-ET-96, ADA vitreous china wall hung siphon jet 0.5 gpf urinal with 3/4" top spud inlet, 2" wall outlet and wall hangers. Color shall be Biscuit
2. Sloan #8186-1.0 G2 Optima Plus, battery powered, sensor operated, urinal flush valve, 1.0 gpf flush with chrome plating, metal cover, back check angle stop, adjustable tail piece, and vacuum breaker.

G. F-6A Urinal, ADA:
1. Kohler #K-4991-ET-96, ADA vitreous china wall hung siphon jet 0.5 gpf urinal with 3/4" top spud inlet, 2" wall outlet and wall hangers. Color shall be Biscuit
2. Sloan #8186-1.0 G2 Optima Plus, battery powered, sensor operated, urinal flush valve, 1.0 gpf flush with chrome plating, metal cover, back check angle stop, adjustable tail piece, and vacuum breaker.

H. F-7 Mop Sink:
1. Fiat #MSB-2424 molded stone mop service basin with 10" high walls complete with stainless steel strainer and drain for caulked connection.
2. Chicago #540-LD897SGC with check valves to prevent backflow, hot and cold wall mounted mixing faucet with vacuum breaker, spout with 3/4" hose threads, integral stop arms, chrome finish, and wall brace. NO EXCEPTIONS

I. F-8A Electric Water Cooler:
1. Elkay # EZSTL8C, Child dual height wall mounted electric water cooler complete with wall hanging bracket, stainless steel top, gray enclosure, push bar and bubbler assembly, cooling tank, dome grid strainer, hermetic compressor, condenser coil, evaporator, precooler, and shall be free from lead containing materials. Unit shall be designed for (1) water and waste connection.
2. McGuire #8902C 1-1/4" cast brass P-trap with cleanout plug and polished chrome finish, or approved equal.
3. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.
4. Elkay #LKAPR-EZL apron for ADA compliance.

J. F-11A Sink:
1. Elkay #LR2219 single compartment self rimming stainless steel sink of seamlessly drawn 20 gauge type 302 stainless steel. The bowl shall be 7.5" deep, 1 3/4" radius corners, polished satin finish, heavy duty undercoating, recessed faucet deck with holes to match faucet, and 3 1/2" drain opening.
2. Kohler #K-30469-CP single side-lever faucet with pull-down sprayer, ceramic disc valve cartridge control, memory position valving, 8" gooseneck swivel/rigid spout with swing restriction pin and 1.5 gpm pull-down sprayer with adjustable spray pattern, 1/2" IPS shanks, integral check stops, brass construction, polished chrome finish.
3. Elkay #LK-35 basket strainer for 3 1/2" opening, strainer, neoprene stopper, and 1 1/2" cast brass tail piece.
4. Kohler #K-9000 chrome plated cast brass P-trap with cleanout plug.
5. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.

K. F-12 Shower:
1. Moen #T8370+2328PF concealed, pressure balancing mixing valve with cast bronze body, Nonmetallic/nonferrous nylon replaceable cartridge, Chrome plated metal face plate, 14732 lever handle, temperature limit stops, color coded temperature scale, straight pattern threaded concealed check stops.
2. Bricor Elite Series B150CH-R shower head 1.25 gpm at measured water pressure, NO EXCEPTIONS

3. Note: Showerhead is specific to Life Time and Plumbing Contractor is to contact Bricor directly at (707) 782-0226 for showerhead. Plumbing Contractor is required to measure water pressure at each end of shower bays and provide information to Bricor and Life Time to ensure the head delivers 1.25 gpm at the measured water pressure at each shower.
4. Speakman Repair Part 25-0276-PC-P enlarged elbow with 54-0079 anchor plate and 48-0216-MO (4) screws.
5. Krage Manufacturing LLC, LTF - Aluminum Shower Valve insert/assembly for mason walls (NO EXCEPTIONS). Phone: 1-719-948-2002. Only PEX piping shall be used within assembly.

L. F-12A Shower, ADA:
1. Most Dependable Fountains Model#564SM, accessible shower, metered shower, foot spray, textured sandstone, push button operated, 1.5 gpm. Complies with NSF-61 lead free act.
2. BrassCraft #HSR17C sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.

M. F-12B Shower, ADA:
1. Kohler K-28209 two-port Digitally controlled thermostatic mixing valve, Antiscald protection, concealed provide with access panel, Prewired with two-prong plug for connection to 110 V AC receptacle. ASME A112.18.1/CSA B125.1, ASSE 1016/ASME A112.1016/CSA B125.16 and UL 1951 compliant. 5 year Warranty.
2. Kohler K-28214 digital shower interface, One touch control of temperature and flow. 1.75 gpm flow restrictor control, system warm-up and pause feature. Mounts on finished wall surface. Provide with 32ft. control cable. Architect to select color.
3. Kohler #K-13689, 10” round rain showerhead, 1.75 gpm, polished chrome finish, ceiling mounted, 3” chrome shower arm and chrome escutcheon.

N. F-13 Shower, ADA:
1. Moen #T8370+2328PF concealed pressure balancing mixing valve with cast bronze body, nonmetallic/nonferrous nylon replaceable cartridge, Chrome plated metal face plate, 14732 lever handle, temperature limit stops, color coded temperature scale, straight pattern threaded concealed check stops.
2. Delta RPW336HDF handheld shower assembly less head with: 36” stainless steel slide/grad bar with mounting screws and metal adjustable slide attachment. Refer to Architectural documents for mounting heights, 69” double spiral metal hand-shower hose; and 90° chrome-plated wall supply elbow with vacuum breaker, less shower head.
3. Speakman Repair Part 25-0276-PC-P enlarged elbow with 54-0079 anchor plate and 48-0216-MO (4) screws.
4. Bricor – Elite Series B150CH-HH hand held shower head 1.25 gpm at measured water pressure, NO EXCEPTIONS.
5. Note: Showerhead is specific to Life Time and Plumbing Contractor is to contact Bricor directly at (707) 782-0226 for showerhead. Plumbing Contractor is required to measure water pressure at each end of shower bays and provide information to Bricor and Life Time to ensure the head delivers 1.25 gpm at the measured water pressure at each shower. Refer to Architectural documents for mounting heights.
6. Krage Manufacturing LLC, LTF - Aluminum Shower Valve insert/assembly for mason walls (NO EXCEPTIONS). Phone: 1-719-948-2002. Only PEX piping shall be used within assembly.

O. F-13A Shower:

1. Moen #T8370+2328PF concealed pressure balancing mixing valve with cast bronze body, nonmetallic/nonferrous nylon replaceable cartridge, Chrome plated metal face plate, 14732 lever handle, temperature limit stops, color coded temperature scale, straight pattern threaded concealed check stops.
2. Delta U495D-60-PK stainless steel 60"-82" hose. Provide with chrome finish.
3. Delta RP61294PR hand shower mount. Provide with lumicoat chrome finish.
4. Speakman Repair Part 25-0276-PC-P enlarged elbow with 54-0079 anchor plate and 48-0216-MO (4) screws.
5. Bricor – Elite Series B150CH-HH hand held shower head 1.25 gpm at measured water pressure, NO EXCEPTIONS.
6. Note: Showerhead is specific to Life Time and Plumbing Contractor is to contact Bricor directly at (707) 782-0226 for showerhead. Plumbing Contractor is required to measure water pressure at each end of shower bays and provide information to Bricor and Life Time to ensure the head delivers 1.25 gpm at the measured water pressure at each shower. Maximum showerhead height is to be 48”.
7. Krage Manufacturing LLC, LTF - Aluminum Shower Valve insert/assembly for mason walls (NO EXCEPTIONS). Phone: 1-719-948-2002. Only PEX piping shall be used within assembly.

P. F-18 Electric Water Cooler with Bottle Filler, ADA:
1. Elkay EZH2O #EZSTL8WS, ADA dual wall mounted electric water cooler with sensor operated bottle filling station. Water cooler complete with wall hanging bracket, stainless steel top, gray enclosure, push bar on front, left, and right, bubbler assembly, cooling tank, dome grid strainer, hermetic compressor, condenser coil, evaporator, precooler, and shall be free from lead containing materials. Bottle filler shall be surface mounted with drain affixed to water cooler, anti-microbial plastic components, 1.5 gpm laminar flow, 30 second shutoff timer, and vandal-resistant bubbler. Mount bottle filler above non-ADA electric water cooler. Bottle filler shall not have a water filter or filter status light.
2. McGuire #8902C 1-1/4" cast brass P-trap with cleanout plug and polished chrome finish, or approved equal.
3. McGuire #LFH2165CC sweat angle stop supply valves with compression discharge fitting for extension to the faucet, or approved equal.
4. Elkay #LKAPR-EZL apron for ADA compliance.

Q. F-19 Emergency Eyewash Station
1. Stingray T2210 epoxy coated, pedestal eyewash station with integral emergency thermostatic mixing valve, stainless steel bowl, (2) aerated sprayers w/ dust covers, 1/2" NPT connections, push handle, 1-1/4” IPS drain connection, floor mounting flange, no filter, certified to meet ANSI Z358.1 requirements.

R. F-20 Emergency Eyewash/Shower:
1. Stingray T5510-EP epoxy coated floor mounted combination shower and eye/face wash system with stainless steel bow, First Air Red ABS shower head and spray heads w/ duct covers, positive hot water shutoff, 1” hot and cold water connection inlets with check valves, integrated emergency thermostatic mixing valve with capacity for 20 gpm flow, stainless steel pull rod with handle, 8” diameter anchored floor mounting base plate shall be certified to meet ANSI Z358.1 requirement.

PART 3 EXECUTION

3.01 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 fixtures level and plumb according to roughing-in drawings.

G. 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.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. 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.

K. Install toilet seats on water closets.

L. 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.

M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. 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.

O. Install shower flow-control fittings with specified maximum flow rates in shower arms.

P. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

Q. Install escutcheons at piping wall and 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."

R. 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 7 Section "Joint Sealants."

3.02 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."

D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 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.

3.04 CLEANING & PROTECTION

A. After all fixtures have been set and ready for use and before the Plumbing Contractor leaves the job, he shall thoroughly clean all fixtures furnished and set by him, removing all plaster, stickers, rust stains and other foreign matter or discoloration on fixtures, leaving every part in an acceptable condition, ready for use.

B. It is the Plumbing Contractors responsibility to protect the floor drain strainers from grout and dirt during construction. Floor drain strainers shall be in new condition at the time of turning the building over to the owner, or new strainers will be required.

3.05 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

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SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 CONDITIONS OF THE CONTRACT

A. Plumbing Contractor is responsible to furnish, install and execute all of the following work as required, specified and/or indicated on plan unless noted to be performed by another contractor.

1.02 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. Thermostatic mixing valves.
   6. Drain tempering valves.
   7. Strainers.
   8. Hose bibbs.
   9. Wall hydrants.
   10. Drain valves.
   11. Water hammer arresters.
   12. Trap-seal primer valves.

B. Related Section:
   1. Division 22 Section “Common Work Results for Plumbing” for joining materials, sleeves, escutcheons, grout, piping joint construction and other common requirements.

1.03 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 860 kPa 125 psig, unless otherwise indicated.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. NSF Compliance:
   1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard: Model HB-15755.
      b. Conbraco Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
   2. Standard: ASSE 1001.
   3. Size: DN 8 to DN 80 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. Conbraco Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Woodford Manufacturing Company.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers (RPZ):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sizes NPS 1/2" – 2": Watts Industries, Inc.; Water Products Div.: Model LF919-QT.
   b. Sizes NPS 2-1/2" – 4": Watts Industries, Inc.; Water Products Div.: Model 957-NRS.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
   c. Pressure Gauge: Install pressure gauge on inlet and outlet.

B. Double Check Valve Assembly Backflow Preventers (DCVA):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sizes NPS 1/2" – 2": Watts Industries, Inc.; Water Products Div.: Model LF719-QT.
   b. Sizes NPS 2-1/2" – 4": Watts Industries, Inc.; Water Products Div.: Model 757-NRS.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure, non-health hazard applications.
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for horizontal or vertical, straight through flow.
7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Dual Check Valves
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sizes NPS 1/2" – 1": Watts Industries, Inc.; Water Products Div.: Model Series 7
2. Standard: ANSI/ASSE 1024.
3. Body: Bronze with union on inlet.

D. Dual Check Valves (beverage)
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sizes NPS 1/4" – 3/8": Watts Industries, Inc.; Water Products Div.: Model SD-3 with strainer.
2. Standard: ANSI/ASSE 1022.
3. Body: stainless steel with union on inlet.

E. High Pressure Hose Drop Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sizes NPS 3/4" – 1": Watts Industries, Inc.; Water Products Div.: Model 912HP.
2. Operation: Protects agains backpressure and backsiphonage.
3. Pressure Loss: 10 psig (83 kPa) maximum, through middle 1/3 of flow range.
4. Body: ASTM B-584 bronze.
5. End Connections: Threaded.
6. Configuration: Designed for horizontal and vertical, straight through flow.
7. Accessories: Vent and drain.

F. Backflow-Preventer Test Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Watts Industries, Inc.; Water Products Div.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.03 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Primary valve:
a. Model: Watts LFM115-74.
b. Size: NPS 3 (DN 80).
c. Design Flow Rate: 50 to 150 gpm (1.26 to 18.93 L/s).
d. Design Inlet Pressure: As indicated on plans.
e. Design Outlet Pressure Setting: As indicated on plans.

5. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Pool Fill Regulators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Maximum working pressure of 300 psi.
4. Primary Valve:
   a. Model: Watts LFN223B.
   b. Size: NPT 2-1/2"
   c. Adjustable Reduced Pressure Range of 25-75 psi.
   d. Design Inlet Pressure: As indicated on plans.
   e. Design Outlet Pressure Setting: As indicated on plans.
5. Body: Lead free cast copper silicon alloy.
6. End Connections: Threaded for NPT 2-1/2 (DN 80).

2.04 BALANCING VALVES

A. Thermostatic Circuit Balancing Valves:
1. Manufacturers:
   a. Circuit Solvers, by Therm Omega Tech, CSUAS-3/4-XXX-CV1, no exceptions.
2. Standards: NSF/ANSI 61 Certified, CA Health & Safety Code 116875.
3. Pressure Rating: 200-psig (2070 kPa).
4. Size: NPS 2 (DN 50) or smaller.
5. Body: 303 stainless steel.
6. Assembly components: Influent ball valve, 20 mesh stainless steel strainer, thermal modulating valve with integral union, check valve, and effluent ball valve. All components are lead free and 302 stainless steel construction.
7. Thermal modulating valve internal components: Valve plug, thermal actuator and carrier are 303 stainless steel, spring is 302 stainless steel.
8. End Connections: Threaded.

2.05 DRAIN TEMPERING VALVES

A. Thermostatic Drain Tempering Valves:
1. Manufacturers:
   a. DTV, by Therm Omega Tech, no exceptions.
2. Self-activated tempering valve for steam generators and dish machine drains to limit the drain effluent into the sanitary sewer system below the maximum allowable temperature of 140°F. Provide cold water connection with backflow protection and water hammer arrestor according to the manufactures installation instructions. The discharge temperature of the valve shall be set to 140°F.

2.06 THERMOSTATIC MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:
1. Materials covered this Article are to be purchased direct from the supplier.
2. Manufacturers:
   a. Lawler - Neptune EMX 200-943040 Electronic Mixing Valve

3. The Plumbing Contractor shall pipe the valve according to the manufactures installation instructions. The discharge temperature of the valve shall be set to 120°F.

B. Point-of-Use, Thermostatic, Water Mixing Valves:
   1. Manufacturers:
      a. Lawler Model #TMM-1070, Part #87500.
   2. The Plumbing Contractor shall furnish and install point-of-use thermostatic mixing valves under each lavatory and hand sink in Childcare, Family Locker Room, Men's Locker Room, Women's Locker Room, pool toilets, Café, Bistro, Bar, and as shown on drawings. The Plumbing Contractor shall pipe the valve according to the manufactures installation instructions. The discharge temperature of the valve shall be set to 100°F.

2.07 STRAINERS FOR DOMESTIC WATER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Crane Co.; Crane Valve Group; Crane Valves.
   2. Spence Strainers International.

B. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
   2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
   3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
   4. Screen: Stainless steel with round perforations, unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).
      b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
      c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).
   6. Drain: Pipe plug for NPS 2 (DN 50) and smaller and factory-installed, hose-end drain valve for NPS 2-1/2 (DN 65) and larger.
   7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Spence Strainers International.

2.08 INTERIOR WALL HYDRANTS (FINISHED AREAS)

A. Interior wall hydrants (HY-1):
   1. Manufacturers: Subject to compliance with requirements, provide Watts HY-330 or a comparable product by one of the following:
      a. Jay R. Smith Mfg. Co.
      b. Woodford Manufacturing Company
      c. Zurn Industries, LLC.
   2. Standard: ASME A112.18.1 for sediment faucets.
   3. Body Material: Stainless Steel.
   4. Seat: Bronze, replaceable.
   5. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
   6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
   7. Pressure Rating: 125 psig (860 kPa).
   8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1052.

9. Finish for Finished Rooms: smooth Polished chrome plated finish, recessed head in stainless steel wall box with smooth polished chrome face and cover for narrow wall construction..
10. Operation for Finished Rooms: Operating key.
11. Include operating key with each operating-key hose bibb.
12. Mounting for Finished Rooms: Recessed, stainless steel wall box with chrome face/cover for narrow wall construction.

2.09 INTERIOR HOSE BIBBS (NON-FINISHED AREAS)

A. Hose Bibbs (HB-1):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Woodford.
   b. Watts Industries, Inc.; Water Products Div.
2. Model:
   a. Interior non-public spaces: Woodford 26P.
3. Standard: ASME A112.18.1 for sediment faucets.
4. Body Material: Bronze.
5. Seat: Bronze, replaceable.
6. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
7. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
8. Pressure Rating: 125 psig (860 kPa).
9. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1052.
10. Finish for Equipment Rooms and Service Areas: Rough bronze.
11. Operation for Equipment Rooms and Service Areas: Metal wheel handle.

2.10 EXTERIOR WALL HYDRANTS

A. Vacuum Breaker Wall Hydrants (HY-2):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Woodford: Model B67.
   b. Wade: 8600
2. Standard: ASSE 1019, Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig (860 kPa).
6. Vacuum Breaker: NIDEL, integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1052.
7. Operation: Loose key.
8. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
9. Inlet: NPS 3/4 (DN 20).
10. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Box: Deep, flush mounting with cover.
12. Box and Cover Finish: Polished nickel bronze.
13. Operating Keys(s): One with each wall hydrant.

2.11 ROOF HYDRANTS

A. Vacuum Breaker Wall Hydrants (HY-3):
   1. Manufacturers: Subject to compliance with requirements, provide Woodford Model SRH-MS or a comparable product by one of the following:
      a. Wade
      b. Jay R. Smith Mfg. Co.
      c. Zurn Industries, LLC.
   2. Standard: ASSE 1057.
   3. Type: Freeze-resistant, automatic draining with venturi action.
   4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
   5. Pressure Rating: 100 psig (860 kPa).
   6. Vacuum Breaker: 50H-BR, drainable, hose-connection vacuum breaker complying with ASSE 1052. In event of failure, the vacum break it is to be replaced with like equal to ensure venturi action can still be preformed while vacum breaker is attatched.
   7. Operation: Loose key.
   8. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   9. Inlet: NPS 3/4.

2.12 YARD HYDRANTS

A. Vacuum Breaker Yard Hydrants (HY-4):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Woodford: Model Y95.
      b. Wade: 8602
   2. Standard: ASSE 1019, Type B.
   3. Type: Freeze-resistant with 4’ bury depth, with automatic drain down.
   4. Pressure Rating: 125 psig (860 kPa).
   5. Vacuum Breaker: Anti siphon NIDEL 34HW , integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
   6. Operation: Loose key.
   7. Casing and Operating Rod: 3/8” galvanized steel pipe, 2’ minimum length required.
   8. Inlet: NPS 3/4 (DN 20).
   9. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   10. Box: Deep, flush mounting with cover.
   11. Box and Cover Finish: Brass casting
   12. Operating Keys(s): One with each wall hydrant.

2.13 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
   1. Standard: MSS SP-110 for full-port, two-piece ball valves.
   2. Pressure Rating: 400-psig (2,758 kPa) minimum CWP.
   3. Size: NPS 3/4 (DN 20).
   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.

2.14 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sioux Chief Manufacturing Company
      b. Precision Plumbing Products
   2. Standard: ASSE 1010 or PDI-WH 201.
   3. Type: Piston with EPDM O-rings.
   4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.15 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sioux Chief Manufacturing Company, Inc.: Model 695.
      b. Precision Plumbing Products: Model P2-500.
   2. Standard: ASSE 1018.
   3. Pressure Rating: 125 psig (860 kPa).
   4. Body: Bronze.
   5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
   6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
   7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Restrictor-Type (where allowed by code):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ProSet Trap Guard: Model TG
         1) The model number is the responsibility of the Contractor to fit installed drain.
         2) ProSet Trap Guard and four inch deep seal traps will be allowed instead of the trap primers noted above.

PART 3 EXECUTION

3.01 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 including each lawn sprinkler service (except if meter is in outside vault), boiler system, domestic water service (except if meter is in outside vault), pool/whirlpool make-up water connection, steam generator and laundry equipment. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system. Verify the specific location with the Owner.
   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. Extend discharge piping from back flow preventer to floor drain with funnel mounted below unit.
4. Do not install bypass piping around backflow preventers.

C. Install water regulators at the main water service entering the building if the service pressure exceeds 80 PSI. Two (2) valves shall be provided piped in parallel with inlet and outlet shutoff valves and installed upstream of the RPZ. Install pressure gages on inlet and outlet.

D. Provide pressure reducing valve on any water connection to equipment that requires a water pressure less than the building service provides. See drawings for locations of Pressure Reducing Valves.

E. Install Circuit Solver balancing valves on each hot water supply branch line downstream of the last runout to a hot tap. No balancing necessary.

F. 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.

G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, and pump.

H. Install water hammer arresters in water piping according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

K. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Intermediate atmospheric-vent backflow preventers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.
4. Water pressure-reducing valves.
5. Primary, thermostatic, water mixing valves.
6. Supply-type, trap-seal primer valves.

L. 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."

M. All control valves not immediately in sight of fixtures and equipment controlled shall be provided with approved metal tags on which shall be stamped identifying description of equipment or piping controlled. Valve tags shall be color coded by adhesive backed labels.

N. Install Reverse Osmosis System per the manufactures specifications.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Mineral tanks must be piped in reverse return as shown and noted on plans.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install shutoff valves and unions on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
   1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves For Plumbing."

E. Install drains as indirect wastes to spill into floor sink.

F. Ground equipment according to Division 26 Section "Grounding and Bonding."

G. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle 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.

3.04 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. In-line, sealless centrifugal pumps.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Wiring Diagrams
   3. Warranty: Sample of warranty.

PART 2 PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 6000 – Product Requirements):
   1. Armstrong Pumps Inc.
   2. Bell & Gossett Domestic Pump; ITT Corporation.
   3. TACO Incorporated.
   4. Grundfos

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps, compliant with domestic water usage.

C. Pump Construction:
   1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
   2. Casing: Bronze, with threaded or companion-flange connections.
   3. Impeller: Plastic.
   4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics: See schedule on plans for size, capacity and accessories.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing 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.

2.03 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
   1. Type: Water-immersion temperature sensor, for installation in piping.
   2. Range: 65 to 200 deg F.
   3. Enclosure: NEMA 250.
   4. Operation of Pump: On or off.
   5. Transformer: Provide if required.
   6. Power Requirement: 120 V, ac.
   7. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

PART 3 EXECUTION

3.01 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install continuous-thread hanger rods of size required to support pump weight.
   1. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
   2. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats (aqua-stat) in hot-water return piping.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
   1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
      a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
      b. Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping."
   2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties."

D. Comply with Division 26 Sections for electrical connections and wiring methods.

E. Connect thermostats (aqua-stat) or timers to pumps that they control.

3.03 ADJUSTING

A. Adjust domestic water pumps to function smoothly and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 22 13 13 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.

B. Related Sections:
1. Mount Olympus Improvemenmt District Standards and Specifications.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

A. Shop Drawings: Pipe materials, manholes (include plan, sections, details and covers).

B. Coordination Drawings: Show pipe sizes, locations, and elevations.

C. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.3 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to

be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification: Light and Heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

    a. Material: ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

    a. Invert Slope: 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

    a. Slope: 8 percent.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

    a. Unshielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
    1. NPS 3 and NPS 4: NPS 4 PVC sewer pipe and fittings, gaskets, and gasketed joints.
    2. NPS 5 and NPS 6: NPS 6 PVC sewer pipe and fittings, gaskets, and gasketed joints.
    3. NPS 8 and NPS 10: PVC sewer pipe and fittings, gaskets, and gasketed joints.
    4. NPS 12 and NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage 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.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

    1. Install piping pitched down in direction of flow, at slope indicated.
    2. Install piping with 48-inch minimum cover.
    3. Install piping below frost line.
    4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
   2. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

   1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 CONNECTIONS

A. Make connections to existing piping and underground manholes in accordance with utility company standards.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
b. Close openings in system and fill with water.
c. Purge air and refill with water.
d. Disconnect water supply.
e. Test and inspect joints for leaks.
f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
b. Option: Test concrete gravity sewer piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 221313

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

B. Related Sections:
   1. Division 7 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items

1.02 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.

1.03 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-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
   1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
   1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
   2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
      a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Cellular-Core ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
   1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
   2. Solvent Cement and Adhesive Primer:
      a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Cellular-Core PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:
   a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil and waste Piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.02 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. 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."

E. 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 2 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.

F. Lay buried building 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.

G. 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 NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 34 and larger.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

K. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. 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."

N. 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."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

P. Above ground ABS or PVC horizontal or vertical lengths greater than 30 feet in total length must be installed according to IAPMO 5-2006 and 9-2006. Thermal expansion and contraction may be controlled by offsets, expansion joints or restraints. Offsets must be 24 inches using 45-degree fittings every 30 feet. A cleanout must be provided in a drainage pipe for each aggregate horizontal change of direction exceeding 135 degrees. Cleanouts and expansion joints must be installed in an accessible location.

Q. ABS or PVC may not be used if located above a ceiling that is considered a mechanical plenum.

3.03 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
   2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.04 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
   1. Use gate or full-port ball valve for piping NPS 2 and smaller.
   2. Use gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
   2. Install backwater valves in accessible locations.
   3. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.05 HANGER AND SUPPORT INSTALLATION

A. 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.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. 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-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. Spacing every other joint unless over 4 feet, then support each joint.
      a. Support adjacent to joint not to exceed 18 inches.
      b. Brace not to exceed 40-foot intervals to prevent horizontal movement.
      c. Support at each horizontal branch connection.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 84 inches with 3/8-inch rod.
   2. NPS 1-1/2: 108 inches with 3/8-inch rod.
   3. NPS 2: 10 feet with 3/8-inch rod.
   4. NPS 2-1/2: 11 feet with 1/2-inch rod.
   5. NPS 3: 12 feet with 1/2-inch rod.
   6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
   7. NPS 6: 12 feet with 3/4-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 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: 48 inches with 3/4-inch rod.

J. Install supports for vertical ABS and PVC piping every 48 inches.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   4. 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.

3.07 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.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.08 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.

3.09 PROTECTION

A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Miscellaneous sanitary drainage piping specialties.

1.02 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.01 CLEANOUTS

A. Exposed Cleanouts (CO):
   1. Manufacturers: Subject to compliance with requirements, provide Josam 58510 or a comparable product by one of the following (Substitutions: See Section 01 6000 – Product Requirements):
      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: as required to match connected piping.
   5. Closure: Countersunk or raised-head, brass, cast-iron or plastic plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Floor Cleanouts (FCO):
   1. Manufacturer: Subject to compliance with requirements, provide Sioux Chief Manufacturing Company, Inc., Model #834 “Finish Line” adjustable cleanout or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Drainage Products Inc.
      d. Zurn Plumbing Products Group
   2. Standard: ASME A112.36.2M for adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Adjustable housing.
   5. Body or Ferrule: to match piping.
   6. Clamping Device: Not required.
   7. Outlet Connection: Spigot or Threaded.
   8. Closure: Brass plug with straight threads and gasket, Cast-iron plug or Plastic plug to match body.
   9. Adjustable Housing Material: Cast iron or Plastic to match pipe with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze

11. Frame and Cover Shape: Square.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Wall Cleanouts (WCO):
1. Manufacturer: Subject to compliance with requirements, provide Josam 58790 or a comparable product by one of the following (Substitutions: See Section 01 6000 – Product Requirements):
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
   f. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: as required to match connected piping.
4. Closure: Countersunk or raised-head, plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.02 FLOOR DRAINS

A. Floor Drains (FD-1):
1. Manufacturer: Subject to compliance with requirements, provide Sioux Chief Manufacturing Company, Inc., Model #833 “Finish Line” adjustable floor drain:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain. With Funnel where noted on plans.
4. Body Material: Ductile Iron.
5. Backwater Valve: Where indicated on plans.
6. Top or Strainer Material: Nickel bronze.
7. Top Shape: Square.

B. Area Drains (AD-1):
1. Manufacturer: Subject to compliance with requirements, provide Sioux Chief Manufacturing Company, Inc., Model #833 “Finish Line” adjustable floor drain:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: PVC.
5. Top or Strainer Finish: Nickel bronze.
6. Top Shape: Square.

2.03 FLOOR SINKS

A. Floor Sinks (FS-1):

1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   a. Sioux Chief Manufacturing Company, Inc.
   b. Josam Company; Josam Div.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group
2. Standard: ASME A112.6.3 With backwater valve where noted on plans.
3. Pattern: Deep basin drain with ½ grate.
4. Body Material: Cast iron with acid resistant porcelain enameled coated interior.
5. Strainer: Aluminum internal dome strainer.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Outlet: Bottom.
10. Dimensions of Top or Strainer: 12x12

2.04 INTERIOR TRENCH DRAINS

A. See drawings for the pool trench drain system and requirements. The Plumbing Contractor in responsible for pool trench drain system.

B. Interior Pool Trench Drains (TD-1):
   1. Manufacturers: Zurn Industries, LLC
      a. Zurn Industries, LLC.: Model Z888-4-PVSS-BG (NO EXCEPTIONS)
   2. Grate and Frame: Heavy Duty Stainless Steel Frame.
   3. Body Material: high density polyethylene.
   4. Outlet: End.
   5. Fittings: Manufactured only.
   6. Provide Sioux Chief 875-4A cleanout bushing with 852-4PNQ adjustable cover with nickel bronze square top. Refer to detail on drawings.

C. Shower Area Trench Drains (TD-2):
   1. Manufacturers: Zurn
      a. Zurn ZS880 (NO EXCEPTIONS)
   2. Grate: Tile In-Lay Grate
   3. Body Material: Stainless steel
   4. Outlet: Bottom.

D. Whirlpool Suite Trench Drains (TD-3):
   1. Manufacturers: Zurn
      a. Zurn ZS880 (NO EXCEPTIONS)
   2. Grate: Tile In-Lay Grate
   3. Body Material: Stainless steel
   4. Outlet: Bottom.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
   2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. 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.

C. Stack Flashing Fittings: Johnson Mansville
   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.

D. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

E. Washer Drain Pan:
   1. Description: One-Piece moded fiberglass construction. Removable aluminum front threshold.
   2. Manufacturer: Subject to compliance with requirements, provide Mustee Model 98 Durapan or a comparable product by one of the following (Substitutions: See Section 01 6000 – Product Requirements):
      a. FloodSaver.
      b. Oatley.

PART 3 EXECUTION

3.01 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 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.
d. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

K. Install washer drain pan under all washing machines. Pipe outlet to floor drain.

3.02 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.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

3.04 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

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SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Grease interceptors.

1.02 ACTION SUBMITTALS

A. Shop Drawings: For each type and size of interceptor indicated.
   1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.01 GREASE INTERCEPTORS

A. Grease Interceptors:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Schier Products Company.
      b. Zurn Industries, LLC.
   2. Standard: PDI G101 and ASME A112.14.3, for intercepting and retaining FOG from food-preparation wastewater.
   3. Cover: Heavy vehicle traffic, cast iron, manhole covers.
   4. Manhole cover: Bolt or locking with air tight gasket seal.
   5. Nameplate: Permanent 4” x 6” label with the words “grease interceptor”.
   6. Interceptors must meet the local codes and City/County ordinances.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 INSTALLATION

A. Equipment Mounting:
   1. Install grease interceptors grease-removal devices [and] solids interceptors on cast-in-place concrete equipment base(s).
   2. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

B. Install precast concrete interceptors according to ASTM C891.

C. Set interceptors level and plumb.

D. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

E. Set tops of manhole frames and covers flush with finished surface in pavements.
   1. Set tops [3 inches] above finish surface elsewhere unless otherwise indicated.

F. Set tops of grating frames and grates flush with finished surface.

G. Set [metal] [and] [plastic] interceptors level and plumb.

H. Set tops of metal interceptor covers flush with finished surface in pavements.
   1. Set tops [3 inches] above finish surface elsewhere unless otherwise indicated.

I. Install piping and oil storage tanks according to Section 231113 "Facility Fuel-Oil Piping."

J. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor unless otherwise indicated.
   2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
   3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
   4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

K. Install grease-removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction.
   1. Install control panel adjacent to unit unless otherwise indicated.

L. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Coordinate oil-interceptor storage tank and gravity drain with Section 231113 "Facility Fuel-Oil Piping."

M. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet.
   1. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

3.03 PIPING CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving."
   1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
   2. Use warning tapes or detectable warning tape over ferrous piping.
   3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Grease interceptors.
   2. Grease-removal devices.
   3. Oil interceptors.
   4. Solids interceptors.

3.05 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. All plumbing shall be installed in accordance with Minnesota Plumbing code.

B. This Section includes the following storm drainage piping inside the building.
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

1.02 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.

1.03 SUBMITTALS

A. Product Data: For each type indicated.

1.04 INFORMATIVE SUBMITTALS

A. Field quality-control inspection and test reports.

B. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

1.05 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.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
   1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: CISPI 301.
   1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
      a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
      b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
   1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
   2. Solvent Cement and Adhesive Primer:
      a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.02 ABS PIPE AND FITTINGS

A. ABS Pipe: ASTM D 2661, NSF14, CSA-B181.1, CS270, ASTM D 2661, Schedule 40, solid wall.

B. ABS Socket Fittings: made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement and Adhesive Primer:
   1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement 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."
   3. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 PVC PIPE AND FITTINGS

A. PVC unthreaded Pipe: ASTM D 2665, NSF14, CSA-B181.2, CS272, ASTM D 2665, Schedule 40, solid-wall drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement and Adhesive Primer:
   1. Adhesive primer shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer 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."
   3. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 60 .00 – Product Requirements):
         1) Dallas Specialty & Mfg. Co.
         2) Fernco Inc.
         3) Mission Rubber Company; a division of MCP Industries, Inc.
         4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      b. Standard: ASTM C 1173.
      c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      d. Sleeve Materials:
         1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
         2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Substitutions: See Section 01 60 .00 – Product Requirements):
      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company; a division of MCP Industries, Inc.
   b. Standard: ASTM C 1460.
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. 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."

D. 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."

E. Make changes in direction for storm 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.

F. Lay buried building drain 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.

G. 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.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install ABS storm drainage piping according to ASTM D 2661.

J. Install PVC storm drainage piping according to ASTM D 2665.

K. Install underground ABS and PVC storm drainage piping according to ASTM D 2321.

L. Plumbing Specialties:
   1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 14 .23 "Storm Drainage Piping Specialties."
   2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 14 .23 "Storm Drainage Piping Specialties."

3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 14 .23 "Storm Drainage Piping Specialties."

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. 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."

O. 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."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

Q. In no case shall water from roof or the sump discharge be allowed to flow upon the public sidewalk, Minnesota Rules, part 1101.1.

R. Draintile material must meet Minnesota Rules, part 1101.5 and have proper drainage fittings. Verify that the draintile sump pump discharges into an approved point of disposal.

S. Above ground ABS or PVC horizontal or vertical lengths greater than 30 feet in total length must be installed according to IAPMO 5-2006 and 9-2006. Thermal expansion and contraction may be controlled by offsets, expansion joints or restraints. Offsets must be 24 inches using 45-degree fittings every 30 feet. A cleanout must be provided in a drainage pipe for each aggregate horizontal change of direction exceeding 135 degrees. Cleanouts and expansion joints must be installed in an accessible location.

T. ABS or PVC may not be used if located above a ceiling that is considered a mechanical plenum.

3.02 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. 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.

D. Plastic, Nonpressure-Piping, Solvent-Cemented 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.03 HANGER AND SUPPORT INSTALLATION

A. 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.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. 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-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 32 inches with 3/8-inch rod.
2. NPS 3: 32 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 32 inches with 5/8-inch rod.
4. NPS 6: 32 inches with 3/4-inch rod.

H. Install supports for vertical ABS and PVC piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.04 CONNECTIONS

A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.05 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.

3.06 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.

3.07 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Underground storm drainage piping NPS 15 and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.
   3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
   4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground storm drainage piping NPS 15 and smaller shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.
   3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
   4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION

SECTION 22 14 20
SUBDRAINAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Perforated-wall pipe and fittings.
   2. Geotextile filter fabrics.

1.02 ACTION SUBMITTALS

A. Product Data: For geotextile filter fabrics.

PART 2 PRODUCTS

2.01 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

2.02 SOIL MATERIALS

A. Soil materials are specified in Section 02 30 .00 "Earthwork."

2.03 WATERPROOFING FELTS

A. Material: Comply with ASTM D 226, Type I, asphalt and/or ASTM D 227, coal-tar-saturated organic felt.

2.04 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.
   1. Survivability: AASHTO M 288 Class 2.
   2. Styles: Flat and sock.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 23 .00 "Excavation and Fill."

3.02 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 12 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 6 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive and/or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 12 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.

J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.03 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 6 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive and/or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.04 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
   1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
   2. Underslab Subdrainage: Install piping level.
   3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
   4. Lay perforated pipe with perforations down.
   5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D 2321.

3.05 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.06 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Division 22 Section "Storm Drainage Piping Specialties."

B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.

C. Install horizontal backwater valves in piping in manholes where indicated.

3.07 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 33 30 .00 "Storm Drainage Utilities."

B. Cleanouts for Foundation Subdrainage:
   1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
   2. In nonvehicular-traffic areas, use NPS 4PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set top of cleanout 1 inch above grade.

C. Cleanouts for Underslab Subdrainage:
   1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
   2. Use NPS 4cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.08 CONNECTIONS

A. Comply with requirements for piping specified in Section 33 30 .00 "Storm Drainage Utilities." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation and/or underslab subdrainage to stormwater sump pumps. Comply with requirements for sump pumps specified in Section 22 14 .29 "Sump Pumps."

3.09 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
   2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

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SECTION 22 14 23
STORM DRAINAGE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. All plumbing shall be installed in accordance with Minnesota Plumbing Code.

B. Section Includes:
   1. Roof drains.
   2. Pool trench drains.
   3. Miscellaneous storm drainage piping specialties.
   4. Cleanouts.
   5. Backwater valves.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.01 METAL ROOF DRAINS

A. Cast-Iron, General-Purpose Roof Drains (RD):
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z-100 or a comparable product by one of the following:
      a. Zurn
      b. Josam
      c. Jay R Smith
      d. Wade
   2. Standard: ASME A112.6.4, for general-purpose roof drains.
   3. Body Material: Cast iron.
   4. Dimension of Body: Nominal 15-inch diameter.
   5. Combination Flashing Ring and Gravel Stop: Required.
   6. Flow-Control Weirs: Not required.
   7. Outlet: Bottom.
   8. Extension Collars: Only if required for installation.
   9. Underdeck Clamp: Required.
   10. Expansion Joint: Not required.
   11. Dome Material: Cast iron.
   12. Perforated Gravel Guard: Not required.
   13. Vandal-Proof Dome: Required.
   14. Water Dam: Not required.

B. Cast-Iron, Medium-Sump, General-Purpose Roof Drains (ORD):
   1. This product to be used only when overflow is located directly next to roof drain.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z-100-89 or a comparable product by one of the following:
      a. Zurn
      b. Josam
      c. Watts

d. Jay R Smith
e. Wade

3. Standard: ASME A112.6.4, for general-purpose roof drains.
4. Body Material: Cast iron.
5. Dimension of Body: Nominal 15-inch diameter.
6. Combination Flashing Ring and Gravel Stop: Required.
7. Flow-Control Weirs: Not required.
8. Outlet: Bottom.
9. Extension Collars: Only if required for installation.
10. Underdeck Clamp: Required.
11. Expansion Joint: Not required.
12. Dome Material: Cast iron.
13. Perforated Gravel Guard: Not required.
14. Vandal-Proof Dome: Required.
15. Water Dam: 2 inches high.

2.02 POOL TRENCH DRAINS

A. See drawings for the pool trench drain system and requirements. The Plumbing Contractor in responsible for pool trench drain system.

B. Exterior Pool Trench Drains (TD-1):
1. Manufacturers: Zurn Industries, LLC.: Model Z888-4-PVSS-BG. (No Exceptions)
2. Grate and Frame: Heavy Duty “HD” Stainless Steel Frame.
3. Body Material: high density polyethylene.
4. Outlet: End.
5. Fittings: Manufactured only.

2.03 POOL DECK AREA DRAINS

A. See drawings for the pool deck area drains and requirements. The Plumbing Contractor in responsible for pool drainage system.

B. Exterior Area Drains (in pavers) (AD-2):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z-158-ZN or a comparable product by one of the following:
a. Josam
b. Watts
c. Jay R Smith
d. Wade
2. Grate and Frame: Polished nickel-bronze 10” square top POM-deck drain w/ heel proof grate and rotatable frame
3. Body Material: Cast iron.

C. Exterior Area Drains (in perimeter landscaping) (AD-3):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z-125 or a comparable product by one of the following:
a. Josam
b. Watts
c. Jay R Smith
d. Wade
2. Grate and Frame: Epoxy coated cast.
3. Body Material: Epoxy coated cast iron.
4. Screen: Stainless Steel Mesh.

2.04 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Down Spout Nozzles:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z-199 or a comparable product by one of the following:
      a. Mifab
      b. Josam
      c. Watts
      d. Jay R Smith
      e. Wade
   2. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
   3. Size: Same as connected conductor.

2.05 CLEANOUTS

A. Floor Cleanouts (CO):
   1. Standard: ASME A112.36.2M, for cleanouts.
   2. Manufacturers:
      a. Mifab
      b. Zurn
      c. Josam
      d. Watts
      e. Jay R Smith
      f. Wade
   3. Size: Same as connected branch.
   4. Type: Adjustable housing.
   5. Body or Ferrule Material: Same as pipe material.
   6. Clamping Device: Not required.
   7. Outlet Connection: Threaded.
   8. Closure: Cast-iron plug or Plastic plug.
   9. Adjustable Housing Material: Same as pipe material with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Square.
   12. Top-Loading Classification: Medium Duty.
   13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Wall Cleanouts (WCO):
   1. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
   2. Manufacturers:
      a. Zurn
      b. Mifab
      c. Josam
      d. Watts
      e. Jay R Smith
      f. Wade
   3. Size: Same as connected drainage piping.
   4. Body Material: as required to match connected piping.
   5. Closure: as required to match connected piping.
   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.

2.06

A. Backwater Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn #Z1090 or a comparable product by one of the following:
      a. Mifab
      b. Josam
      c. Watts
      d. Jay R Smith
      e. Wade
   2. Body Material: Dura-Coated cast iron with gasketed bolted cover.
   3. Inlet: no hub.
   4. Outlet: no hub.
   5. Flapper: automatic PVC with O-ring.

PART 3 EXECUTION

3.01 INSTALLATION

A. 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 Sections.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Install expansion joints, if indicated, in roof drain outlets.
   3. Position roof drains for easy access and maintenance.

B. Install downspout nozzles at grade with top 18 inches above grade. Secure to building wall.

C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
   1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   3. Locate cleanouts at minimum intervals of 100feet for piping.
   4. Locate cleanouts at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install test tees in vertical conductors and near floor.

G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 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

SECTION 22 14 29
SUMP PUMPS

PART 1 GENERAL

1.01 CONDITIONS OF THE CONTRACT

A. Plumbing Contractor is responsible to furnish, install and execute all of the following work as required, specified and/or indicated on plan unless noted to be performed by another contractor.

1.02 SUMMARY

A. Section Includes:
   1. Submersible sump pumps.
   2. Sump-pump basins and basin covers.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.04 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps (Drain tile and deck drain):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Zoeller Company.
   2. Description: Factory-assembled and -tested sump-pump unit.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Non-corrosive engineered plastic, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
   5. Impeller: Statically and dynamically balanced, plastic design for clear wastewater handling, and keyed and secured to shaft.
   6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
   7. Seal: Mechanical.
   8. Capability: Pass 3/8 inch (9.5 mm) solids (sphere).
   9. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   10. Controls:
      a. Enclosure: NEMA 250, Type 1.
      b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
      c. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).

d. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. High Water Alarm:
    a. Manufacturer: SJE Rhombus
    b. Model: TA AB-01H
    c. Voltage:
        1) Primary: 120 VAC, 60 Hz, 2.4 watts max.
        2) Secondary: 9 VDC
    d. Battery Backup Power: 9 VDC
    e. Alarm Enclosure: Nema 1 plastic.
    f. Float Switch Connection Terminal:
        1) Float Switch: SJE SignalMaster control switch with mounting clamp.
        2) Cable: 15 feet, flexible 18 gauge, 2 conductor SJOW, water resistance.

2.02 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
    1. Material: Fiberglass.
    2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
    3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
    1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

2.03 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for Plumbing 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. Motors for submersible pumps shall be hermetically sealed.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavation and filling are specified in Division 2 Section "Earthwork."

3.02 INSTALLATION

A. Pump Installation Standard: Comply with ANSI HI 1.4 for installation of sump pumps.

3.03 BASINS

A. See plumbing drawings for basin sizes and locations.

END OF SECTION

SECTION 22 31 00
WATER SOFTENERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes commercial water softeners.
   1. Chemicals.
   2. Water testing kits.

1.02 SUBMITTALS

A. Product Data: For each type of water softener and water testing kit indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and connections to piping systems.
   1. Include wiring diagrams.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.03 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.

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.
   1. Water Softener, Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 COMMERCIAL WATER SOFTENERS

A. Description: Factory-assembled, pressure-type water softener.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
      a. Water Control Corporation
   2. Comply with NSF 61, "Drinking Water System Components--Health Effects."
   3. Model: Progressive/metered water softening system. See plumbing drawings.
   4. Configuration: Mineral tank(s) and [1] brine tank. See plumbing drawings.
   5. Mineral Tanks: Fiberglass, electric welded; pressure-vessel quality.
      a. Construction: Fiberglass reinforced polyester, reinforced with a continuous roving glass filament overwrap. Tanks shall have a molded polypropylene base for support. Non-ASME code.
      b. Pressure Rating: 1034 kPa (150 psig) minimum.
      c. Wetted Components: Suitable for water temperatures from 5 to at least 50 deg C (40 to at least 120 deg F).
      d. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.

e. Distribution System: Hub and lateral type distributor system with PVC riser; fabricated from PVC pipe and fittings with individual, fine-slotted, non-clogging PE strainers; arranged for even flow distribution through resin bed.
f. Provide pressure vacuum breaker on mineral tank as required by manufacturer.

6. Control: Fully automatic; factory mounted on unit and factory wired, electronic controller for programmable variable on demand mode which brings unit on and off depending on service flow.
   a. Control valves shall be of all brass construction, multi-port for maximum flow, and have 2” NPT inlet/outlet connections.
   b. Control valves shall be motor driven, mechanically activated design with five positions to accomplish the regeneration steps of backwash, brine and rinse, rapid rinse, brine refill, and service.
   c. Control valves shall be fitted with a brine injector assembly, and a self-adjusting backwash flow control.
   d. Control system will display status of each tank with respect to service and regeneration.
   e. Controller shall progressively bring additional units on and off-line, as needed, to maintain flow rates and reduce risk of channeling.
   f. Softening system shall include 2” meters located on the outlet side of each softener control.
   g. System shall be programmed so units are unable to regenerate simultaneously.
7. Brine Tank: Combination measuring and wet-salt storing system.
   a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
   b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
   c. Size: Large enough for at least two regenerations at full salting.
8. Warranty: 1 Year.

B. Capacity and Characteristics:
1. Service: Cold and hot water.
2. Continuous Service Flow Rate: 136 gallons per minute continuous at a 15 psi drop.
3. Peak Service Flow Rate: 182 gallons per minute peak at a 25 psi drop.
4. Minimum Service Flow Rate: 96 GPM at 7 psi drop.
5. Water Consumption: 40,000 gal./day.>
6. Water Demand: 24 hours/day.
7. Number of Mineral Tanks: Two.
8. Mineral Quantity, Each Tank: 10 cu. ft..
9. Mineral Exchange Capacity: 4000 grains/cu. ft. per lb of salt.
10. Manifold Pipe Size: 1-1/2.
11. Backwash to Drain Pipe Size: 1-1/2.
12. Electrical Characteristics:
    a. Volts: 120.
    b. Phases: 1.
    c. Hertz: 60.
13. Salt Capacity: 850 lb.

2.02 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb (6.8 kg) of salt.

B. Salt for Brine Tanks: High-purity sodium chloride; free of dirt and foreign material. Rock and granulated forms are not acceptable.
   1. Form: Processed, food-grade salt pellets.

PART 3 EXECUTION

3.01 WATER SOFTENER INSTALLATION

A. Install commercial water softener equipment, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

B. Install brine lines and fittings furnished by equipment manufacturer.

C. Field install mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks as furnished by equipment manufacture.

D. Install flow meters furnished by equipment manufacture and install in copper piping to softener per manufacturer’s installation instructions.

E. Mount softener controller in accessible location for programming and monitoring system.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Mineral tanks must be piped in reverse return as shown and noted on plans.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Division 22 Section "Common Work for Plumbing."

D. Provide pressure vacuum breakers on each softener in copper piping to softener per manufacturer’s installation instructions.

E. Install shutoff valves and unions on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
   1. Metal general-duty valves are specified in Division 22 Section "General-Duty Valves For Plumbing."

F. Install drains as indirect wastes to spill into floor sink.

G. Ground equipment according to Division 26 Section "Grounding and Bonding."

H. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   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 unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.04 STARTUP SERVICE

A. The Plumbing Contractor is responsible to complete and sign the “Request for start-up” checklist attached and return to Water Control Corporation.

B. The Plumbing Contractor is responsible to add water to brine tanks and fill with salt.
   1. Commercial Water Softeners: Plain salt pellets – 500 lbs

END OF SECTION

SECTION 22 33 00
ELECTRIC DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Thermostat-control, electric, tankless, domestic-water heaters.
   2. Domestic-water heater accessories.

1.02 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Wiring Diagrams
   2. Warranty: Sample of special warranty.

1.04 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Warranty Periods: From date of Substantial Completion.
      a. Electric, Tankless Domestic-Water Heaters: Five years.
      b. Compression Tanks: Five years.

PART 2 PRODUCTS

2.01 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
      a. Chronomite Laboratories, Inc.
      b. Eemax, by Rheem
   2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
   3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
      a. Connections: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig.
      c. Heating Element: Resistance heating system.
      d. Temperature Control: Thermostat.
      e. Safety Control: High-temperature-limit cutoff device or system.
      f. Jacket: Aluminum or steel with enameled finish or plastic.

4. Support: Bracket for wall mounting.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. AMTROL Inc.
      b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
      c. State Industries.
      d. Taco, Inc.
   2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   3. Construction:
      a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      c. Air-Charging Valve: Factory installed.
   4. Capacity and Characteristics:
      a. See schedule on plans for size, capacities, dimensions, etc.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

G. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.03 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete."
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   4. Anchor domestic-water heaters per manufacturers instructions.

B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

D. Fill electric, domestic-water heaters with water.

E. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.04 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.
   2. Leak Test: After installation, charge system 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 operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 22 35 00
DOMESTIC HOT WATER HEAT EXCHANGERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.02 SUMMARY

A. This Section includes the following:
   1. Domestic hot water heat exchangers.
   2. Expansion Tanks.
   3. Heat-exchanger accessories.

B. Materials covered by this Section are to be purchased direct from the supplier unless noted otherwise (NO EXCEPTIONS). See General Provisions for Plumbing 22 01 00 Section for approved supplier/vendor list. This contractor shall review and adjust shop drawings as necessary, coordinate shipping dates, receive products on the job site, store the product until installation and shall install the product as if it had been purchased by the contractor.

1.03 SUBMITTALS

A. Product Data: For each type and size of heat exchanger indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

D. Warranty.

E. LEED Submittal:
   1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

1.04 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of 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 storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

B. Warranty Period(s): From date of Substantial Completion:
1. Plate Domestic Water Heat Exchangers:
a. Heat Exchanger: 5 years
2. Service Policy: One year.

PART 2 PRODUCTS

2.01 PLATE DOMESTIC WATER HEAT EXCHANGERS

A. Brazed Plate Double Wall Heat Exchangers:
1. Manufacturers:
a. Aerco International, Inc.
2. Description: Packaged heat-exchanger, circulator pump, 3-way control valve, prewired controls, and specialties for heating domestic water with heating hot water in coil.
3. Flow Pattern: Standard-flow arrangement, with water from bottom of storage tank circulated across heat-exchanger and returned to tank. Include hot-water outlet located at top of tank and temperature sensor in tank.

B. Heat-Exchanger Coil: Counter-Flow, double-wall 316L stainless steel brazed plate with enhanced plates for improved heat transfer. ASME Section VIII, Div. 1 stamped and National Board Registered for 362 psi (2495.90 kPa) Maximum allowable working pressure.
1. The heat exchanger will be a vertical, double-wall, copper tube design utilizing counter flow paths for the potable water and the steam. The exchanger will be ASME stamped, section VIII and rated for 150 psi (1034.21 kPa) operating pressure at 250°F.
2. The heat exchanger will be mounted on a separate skid for field connection to the sidearm storage tank. Heat exchanger to tank piping will factory pre-assembled and shipped separately for field installation. All piping to and from the potable water side of the exchangers will be non-ferrous.
3. Potable water piping to the heat exchanger will include a bronze y-strainer with a blow down valve.
4. Potable water piping will include isolation valves to allow clean in place. Dedicated clean-in-place ball valves will be provided.
5. Potable water piping to the heat exchanger will include a bronze circulator properly sized for the heat transfer requirements and pressure drop through the factory pre-assembled piping.

C. Temperature Control: The storage will include an electronic operating thermostat with digital temperature readouts. BAS will be able to read sensed temperatures and temperature alarm status and over-write the operating set point to engage nighttime setback of stored water temperature if desired.
1. A protocol gateway for BacNet MSTP/IP will be provided.

D. Accessories
1. Bronze T & P relief valve, conforming to ANZI Z21.22, set at 150 PSIG/210°F
2. Y-strainers with blowdown valve for boiler water and domestic water.
3. Boiler water strainer differential pressure gauge.
4. Bronze ball type isolation valves
5. 3/4" Bronze domestic water drain valve.
6. Domestic water Air Vent rated for either 150 PSIG operation.

7. Support: Factory mounted on skids.

2.02 HEAT-EXCHANGER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select relief valves with sensing element that extends into heat-exchanger storage tank.

B. Expansion Tanks:
   1. Manufacturers:
      a. Amtrol: Model ST-120V-C.
   2. Description: Precharged, bladder type, labeled for potable water.
   3. Capacity: 66 gallon (250 liters).

2.03 STORAGE TANK

A. The storage tank shall be ASME Section IV stamped and National Board Registered for a maximum allowable working pressure of 150 psi (1034.21 kPa) and pressure tested at 1-1/2 times working pressure.

B. All tank fittings shall be non-ferrous. Tank shall be equipped with a ball-type drain valve on the bottom head tank. Tank design will include a man way sized access to the tank interior. Tank will include a combination temperature and pressure relief valve.

C. The storage tank shall be an unlined pressure vessel constructed from phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion and mill certified per ASTM A 923Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance. The material selected shall be tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2and ASTM G123 - 00(2005) “Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution.”

D. Waterside surfaces shall be welded internally utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.

E. All internal and external tank surfaces shall undergo full immersion passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces. Other passivation and pickling methods are not accepted.

F. Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. Storage tank materials shall contain more than 80% post-consumer recycled materials and be 100% recyclable.

G. Water contacting tank surfaces will be non-porous and exhibit 0% water absorption.

H. Lined or plated storage tanks will not be acceptable.

I. The water heater will not require anode rods and none will be used. Tanks that employ either sacrificial or impressed current anodes will not be acceptable.

J. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.

PART 3 EXECUTION

3.01 HEAT-EXCHANGER INSTALLATION

3.02 CONNECTIONS

A. Install piping adjacent to heat exchangers to allow service and maintenance. Arrange piping with unions for easy removal of heat exchangers.

B. Ground equipment according to Division 26 Section "Grounding and Bonding."

C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, confirm proper operation of circulating pump and 3-way mixing valve.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 22 52 13
STEAM ROOM GENERATORS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Steam room generator.
   2. Steam room generator accessories.

1.02 SUBMITTALS

A. Product Data: For each type of indicated.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenence data.
   1. Shop Drawings
   2. Wiring Diagrams.
   3. Warranty.

1.04 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steam generator that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period(s): From date of Substantial Completion: One Year.

PART 2 PRODUCTS

2.01 STEAM ROOM GENERATOR

A. Circulating, Storage Heat Exchangers:
   1. Manufacturers:
      a. Lattner: Model BF-36 ASME.
   2. Description: Packaged, electric, horizontal steam generator. Each single unit factory mounted, installed, and piped on a single rack.
   3. Heating Element: 36 kw
   4. Power Requirement: 480 Volt, 3 phase power
   5. Reservoir: Carbon steel
   6. Accessories:
      a. Auto drain valve.

b. Timed automatic blow down.
c. Pressure switch.
d. Pressure limit switch.
e. Complete packaged controls.
f. Remote room sensor.
g. Low voltage temperature/time remote controller.
h. Water level probe and electric water solenoid valve.

7. Distribution Piping: Each unit shall have a NPS 1/2 (DN 15) make-up water pipe, complete with NPS 1-1/4 (DN 32) branch steam pipe to each steam room with a steam head.
8. Units shall be installed and piped as noted on the detail on the plan.

PART 3 EXECUTION

3.01 STEAM GENERATOR INSTALLATION

A. Install steam generators level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Anchor steam generators to substrate.

C. Install makeup water, steam distribution piping and steam head for each steam generator. Steam distribution piping from each steam generator shall be NPS 1-1/4 (DN 32) branch steam pipe to each steam room. Plumbing Contractor shall install connect NPS 1/2 (DN 15) steam nozzle (furnished by equipment supplier) to NPS 1-1/4 (DN 32) branch pipe with bushing at wall in location shown on plan.

D. Install steam generator drain piping as indirect waste to spill by positive air gap into floor sink. Install hose-end drain valves at low points in water piping for steam generator that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

E. Install NPS 1/2 (DN 15) male fitting in steam discharge line of each steam generator for owners in-scent injector.

F. Install aroma tank and pipe to male fitting in steam discharge line.

G. Fill steam generators with water.

3.02 CONNECTIONS

A. Install piping adjacent to steam generator to allow service and maintenance. Arrange piping for easy removal of steam generators.

B. Ground equipment according to Division 26 Section "Grounding and Bonding."

C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.

B. Perform the following field tests and inspections and prepare test reports:
1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace steam generators that do not pass tests and inspections and retest as specified above.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain steam generators. Refer to Division 1 Section "Contract Closeout."

END OF SECTION

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SECTION 23 00 00
DIVISION 23 TABLE OF CONTENTS

DIVISION 23 – HVAC

23 01 00 - GENERAL PROVISIONS FOR HVAC

23 01 00 - General Requirements for HVAC
23 01 30.51 - HVAC Air-Distribution System Cleaning
23 05 00 - Common Work Results for HVAC
23 05 13 - Common Motor Requirements for HVAC Equipment
23 05 16 - Expansion Fittings and Loops for HVAC Piping
23 05 17 - Sleeves and Sleeve Seals for HVAC Piping
23 05 19 - Meters and Gauges for HVAC Piping
23 05 23 - General-Duty Valves for HVAC Piping
23 05 29 - Hangers and Supports for HVAC Piping and Equipment
23 05 53 - Identification for HVAC Piping and Equipment
23 05 93 - Testing, Adjusting, and Balancing
23 07 13 - Duct Insulation
23 07 16 - HVAC Equipment Insulation
23 07 19 - HVAC Piping Insulation
23 08 00 - Commissioning of Mechanical Systems
23 09 34 - Variable-Frequency Motor Controllers for HVAC
23 11 23 - Facility Natural-Gas Piping
23 21 13 - Hydronic Piping
23 21 14 - Hydronic Specialties
23 21 23 - Hydronic Pumps
23 31 00 - HVAC Ducts and Casings
23 33 00 - Duct Accessories
23 34 23 - HVAC Power Ventilators
23 35 01 - Dryer-Vent Exhaust Collection Systems
23 36 00 - Air Terminal Units
23 37 13 - Diffusers, Registers, Grilles and Louvers
23 51 00 - Breechings, Chimneys and Stacks
23 52 16 - Condensing Boilers
23 57 00 - Hydronic Heat Exchangers
23 74 13 - Packaged, Outdoor, Air-Handling Units
23 81 26 - Split System Air Conditioning Units
23 82 19 - Fan Coil Units
23 82 39 - Electric Heaters
23 83 16 - Radiant-Heating (Snow & Ice Melt) Hydronic Piping

END OF SECTION

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SECTION 23 01 00
GENERAL REQUIREMENTS FOR HVAC

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this division of the specifications and accompanying drawings shall be included in one or multiple sub-contracts as coordinated with the General Contractor and shall encompass the following systems:
   1. Heating, Ventilation & Air Conditioning
   2. Temperature Control System.
   3. Refer to the following for additional requirements.
      a. Bidding Requirements, Contract Forms and conditions of the Contract (Division 0)
      b. General Requirements (Division 1)
      c. Geotechnical Investigation (Section 2010)

B. The Scope of Work for each of these systems shall be further defined within the limits of the appropriate section.

C. Sections numbered 23 01 00 thru 23 05 00 shall apply to any and all separate HVAC/Mechanical contracts as well as those sections and articles of particular concern.

1.02 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in this Specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with the existing conditions and limitations. No extra charges or extension in schedule will be allowed because of the contractor' s misunderstanding as to the amount of work involved or lack of knowledge of any site conditions which may affect the work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum.

1.03 FEES, PERMITS, TAXES AND INSPECTIONS

A. Regular inspections shall be requested by the contractor as required by regulations. Charges for the inspections by regulating agencies of installations or plans and specifications shall be paid by the contractor.

B. All permits, inspections and licenses shall be secured and paid for before actual work is started.

C. The contractor, after completion of work, shall furnish to the Owner a Certificate of Final Inspection and approval from the inspection bureau having jurisdiction.

D. State and Local Sales Tax. The Mechanical Contractor shall include all state and local sales tax in the bid. The contractor shall maintain accurate records of all taxes and furnish such records to the Owner upon request.

1.04 CODES AND STANDARDS

A. Contractor shall comply with all current ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the Contract Documents, the most stringent shall govern. The contractor shall promptly notify the Engineer in writing of such difference.

C. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Contractor shall initiate, maintain, and supervise all safety pre-cautions required for his work including regulations of the Occupational Safety and Health Administration (OSHA).

E. Concrete work. Comply with governing regulations.

1.05 DRAWINGS

A. The drawings are to scale as noted but the contractor shall refer to Architectural and structural Drawings for exact location of partitions, walls, beams, shafts, equipment, etc.

B. Each trade shall avail himself of drawings and specifications of all other trades and make an effort to coordinate his work with all other trades.

C. Each Contractor shall give careful consideration to the work of all other trades and all subsidiary contractors and organize the work so that it will not interfere with work of other trades. Consult the plumbing, sprinkling, heating, ventilating and electrical drawings and specifications for correlating information and the architectural and structural drawings for details, dimensions, foundations, structural elements, pits, etc. The Contractor shall verify all dimensions and conditions, and shall coordinate installation of equipment before fabricating ductwork, piping, etc.

1. Consideration has been given to such condition of limited space in the preparation of the drawings and the locations and dimensions of equipment have been selected accordingly. The contractor shall be warned that in certain instances, space may be limited to the extent that there may be only one arrangement of equipment or facilities which will allow installation of same.

D. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work to eliminate such discrepancies with no change in contract cost.

E. The piping and HVAC systems shall be installed substantially as shown on the drawings. The exact position and required offsets of each and every pipe and duct cannot be given by scaling the drawings but shall in every case be placed so as to avoid interference with other work. It is the Contractors responsibility to field measure piping and ductwork prior to fabrication to avoid conflict with structure, ceiling heights and other trades. Should it be necessary to make changes in the location of piping and ductwork for its proper installation and operation, or to avoid conflict with other trades, it shall be done by this Contractor without extra charge to the contract.

F. Piping in finished rooms shall be concealed in partitions, furred spaces or suspended ceilings. In unfinished rooms, piping shall be arranged to provide for a maximum of head room.

G. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

H. Where a disagreement exists in the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost, shall be included.

1.06 SYMBOLS AND ABBREVIATIONS

A. Refer to Symbols and Abbreviations listed on drawings. Other symbols are in common usage but if uncertainty exists regarding plan symbols or abbreviations they shall be brought to the attention of the Engineer for clarification.

B. Where the phrase starts “Provide----,” “provide” shall be construed to mean the same as “Furnish and install-----“.

1.07 PRIOR APPROVAL

A. Prior Approvals. The acceptance of materials and equipment shall be based on the following conditions:
   1. The contractor shall adhere rigidly to the specifications and shall use exact equipment specified or an approved substitution. Where the words “or equal”, or similar, are used in the specifications, other manufacturers will be considered for acceptance as substitutions; however, such requests must be submitted by a bidding contractor for review prior to bidding. If the contractor desires tentative acceptance of a brand of merchandise not specified, sufficient data shall be submitted to the Engineer for appraisal 240 hours before the time set for bides to be received. If any manufacturer or brands other than those specified, are acceptable to the Engineer, the Engineer will indicate before bids are received; however, such acceptance must still be obtained as described in the following. Equipment which is not specified, or is not approved by addendum will not be considered.

1.08 SHOP DRAWINGS

A. The quantity of Shop Drawings to be submitted shall be as noted in the General Conditions.

B. Shop Drawings shall be submitted by Specification section; all items in each section shall be one (1) bound submittal.

C. Shop Drawings shall be submitted electronically in PDF format. Utilize project document management site to post and manage submittals. Clearly make all submittals with flags or highlights to indicate exact products and options being supplied.

D. Engineer will review initial submittal and one resubmittal. If shop drawings are required to be submitted more than two times dues to Contractor not submitting proper documentation or products, Engineer shall charge Contractor for more time spent reviewing the additional submittals.

E. Acceptance of certain items of equipment, designated by the Engineer, will be based on the manufacturer’s shop drawings and pamphlets which shall be submitted to the Engineer. The contractor shall be prepared to submit samples of equipment or material for appraisal when requested by the Engineer. No materials or equipment shall be installed until the Engineer has given acceptance in writing.

F. The contractor shall supply other trades with approved detail drawings of furnished equipment in the event that equipment will affect the work of other contractors.

1.09 LUBRICATION

A. At the time of installation, and before any equipment is operated for either temporary conditions or performance tests, the Contractor shall properly lubricate all items as necessary according to the manufacturer's recommendations. Where special greases or oils are required, the contractor shall furnish to the Owner, at the time of Owner’s instruction, a one year's supply of such special lubricants.

1.10 TEMPORARY CONDITIONING

A. Refer to Division 1, Article 01 07 1 for basic requirements of temporary facilities and services. Information provided in Division 23 01 00, shall be considered supplemental to, but is not intended to prevail over that stated in Division 1.

B. During the construction of the building, prior to enclosure, each separate contractor shall provide all heat, fuel, and services necessary to protect all of his work and materials against injury from dampness and cold until the building has been enclosed. He shall provide approved temporary heating services, adequate and proper fuel, fires, enclosure, hay, etc. for the work of his trades, and shall have watchmen, as required, constantly in attendance when fires are burning. Salamander heaters in enclosed spaces will not be allowed.

C. The General Contractor shall enclose the building as promptly as possible. The building shall be considered enclosed when the roof is on and doorways, window openings and other openings are closed so as to provide a reasonable retention of heat.
   1. Once the building has been enclosed, the HVAC Contractor and Plumbing Contractor shall temporarily install approximately 3 roof-top units as designated by the Owner including gas pipe and duct work for use as temporary heat. The HVAC Contractor shall maintain protection with appropriate filters at the permanent heating/ventilating equipment until the time of turning the units and system over to the Owner. Air filters in temporary heat units shall be changed every two weeks until the spaces are finished. Filter media shall be installed on return air ducts and also changed every two weeks until the spaces are finished. Mechanical equipment installed prior to completion of the taping and sanding of gypsum walls and ceilings shall utilize the maximum amount of fresh air allowed by the particular unit. Any supply unit used for temporary heat shall have filter changes done as indicated above.

D. Once the equipment is in place and the facility is ready for temporary heating functions, the controls at the 3 units shall be installed in a temporary manner by the HVAC Contractor including furnishing of the stats (non-EMS sensors). The units shall not be connected to the EMS system, but shall instead cycle on the temporary stats until the time of turning the units and system over to the Owner.

E. Approximately 12 weeks prior to turning the facility over to the Owner for occupancy, the HVAC Equipment Supplier / Temperature Supplier shall start up all unit (including the 3 units that have been used for temporary heat) checking for proper operation and shall initiate the control system testing for all required sequences. The one year guarantee period shall commence from that date.

1.11 TRADE CONSIDERATIONS

A. Intra-Contract Boundaries:
   1. For plumbing equipment which is specified under separate sections the Plumbing Contractor will be required to furnish and install the necessary "P" traps, stop valves etc. including rough-in and final connections. Final quantity and rough-in locations for Bistro and Café equipment shall be installed according to Kitchen Equipment Supplier shop drawings.
   2. The Plumbing Contractor shall furnish and install copper p-traps and condensate piping to drip into roof drains for all the roof top units according to manufactures recommendations and local codes.
   3. Flues for gas fired appliances (cloth dryers, etc.) shall be installed by the HVAC Contractor including hook-up to the appliance.
   4. Venting and combustion air to boilers shall be by the HVAC Contractor.
   5. See Temperature Control plans for Trade responsibilities for install of the Temperature control equipment.
   6. Refer to the pool equipment documents for plumbing and ventilation connections required for the pool system. Coordinate during shop drawing preparation with the pool shop drawings to assure final connections of appropriate sizes and locations as required to support the pool system.

B. Electrical Service, Wiring and Connections:

1. The Electrical Contractor shall provide electrical service to all motors and other mechanical equipment (unless otherwise noted) in conformance with Division 26 of the specifications. The service to packaged equipment shall include power wiring, disconnect switch and the proper connection to the equipment and above items as required. The service to non-packaged equipment shall include power wiring, disconnect switch, motor starter (complete with thermal overload protection and auxiliary dry contacts) and the proper connection to the equipment and above items as required. In cases where mechanical equipment is specified to have single point power connections, and Mechanical Contractor furnishes and installs equipment of multiple connection points, the Mechanical Contractor shall be responsible for additional costs.
2. All wiring for the control of mechanical motors and equipment shall be furnished complete by the Mechanical Contractor including but not limited to wiring, conduit, devices and installation by a licensed Sub-contractor utilizing Electricians experienced in the types of systems to be installed. All work shall be installed in compliance with NEC regulations and shall be laid out in strict conformance with the wiring diagrams as provided by the manufacture of each section of equipment. It shall be the Mechanical Contractor's responsibility to coordinate all necessary wiring diagrams and shop drawings with the temperature control Sub-contractor for proper lay-out.
3. Where the Mechanical Contractor extends a circuit provided by the Electrical Contractor, all necessary circuit protection shall be provided by the Mechanical Contractor at points where conductor size is reduced or where the equipment requires special protection. Such circuit protection may be fuses of the cartridge type only. At least one spare fuse of each type must provided to the Owner.
4. If the Mechanical Contractor proposes to furnish equipment having electrical requirements different from that specified, it shall be the Mechanical Contractor's responsibility to make necessary additions or revisions to the circuit components, and to cover related costs.
5. Refer to motor schedule shown on electrical drawings for exact items furnished by Electrical Contractor and the number of contacts and items of control which Electrical Contractor will wire.
6. All factory wiring must be certified by an Independent Testing Lab to comply with N.E.C., ANSI, NFPA, and other regulatory agencies and carry a seal to this effect.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 RECORD DRAWING NOTES

A. The contractor shall record all changes and deviations from the Contract Drawings. Refer to Division 1 for specific requirements. Include the following as a minimum:
   1. Prepare Record Drawing changes for all mechanical work within the building that occurs during the progress of construction. Include such changes as:
      a. Addenda
      b. Change orders
      c. Value engineering

B. The Record Drawings shall be maintained at the job site and be subject to review by the owner or architect/engineer during the construction period. This record keeping requirement shall not be construed as authorization for the contractor to make changes in the layout without definite instructions by the architect/engineer in each case.

C. At the completion of the project, one (1) set of Record Drawings shall be delivered to the Architect/Engineer. This work shall be completed and accepted by the Architect/Engineer before approval of final payment.

3.02 OPERATING AND MAINTENANCE MANUAL(S)

A. The contractor shall collect, gather and assemble manuals, each to contain the installation details, instructions, schematics of actual equipment and operations directions supplied by the manufacturer with equipment for the equipment and materials furnished under Division 23. Provide complete listing of suppliers and distributors where replacement parts or maintenance services are available. Manuals shall be submitted in 3-ring binder format and organized according to specification section. Label cover of manuals with project name; date of completion; and mechanical contractor' s name, address, and telephone number. Final acceptance of the work will be withheld until such data has been presented complete to the engineer for transmission to the owner. The manual shall be prepared in time for engineer to review and for contractor to make corrections before owner instruction of operations and maintenance of equipment and systems is scheduled to begin. The manuals may be submitted as a PDF set in lieu of a paper set.

B. Manuals shall include, but not be limited to, the following:
   1. Copies of final Shop Drawings
   2. Copies of manufacturers’ warranties
   3. Copies of all test results
   4. Copies of all mechanical inspector’s reports
   5. Manufacturer’s operating instructions for equipment
   6. Manufacturer’s wiring and installation instructions for equipment.
   7. Equipment parts list based on each specification section.
   8. Local equipment supplies/rep’s names, addresses, and telephone numbers.
   9. Equipment manufacturers’ names, addresses, and telephone numbers.
   10. Subcontractors’ names, addresses, and telephone numbers
   11. Refer to individual sections in Division 23 for additional requirements

C. Cross out or delete all information shown on Shop Drawings and other literature definitely not applying to this particular project and its equipment installed.

D. Manuals that do not meet the foregoing criteria will be rejected and returned to the contractor for resubmittal.

3.03 FINAL OBSERVATION

A. A final observation of the mechanical systems by the Architect/Engineer will be conducted before the contract can be considered complete. The contractor shall inform the Engineer in writing when the mechanical installation is complete and ready for final observation. The Engineer shall visit the project and provide a list of items that need to be corrected or completed to achieve final completion. Should the Engineer attend the project to conduct the final observation and discovers that the work is not sufficiently complete to perform this task, then the contractor shall compensate the Engineer for his time. The contractor shall remain responsible for completing his work and requesting the Engineer to return for a final observation.

3.04 TESTS

A. The contractor shall test the equipment installed under this specification and shall demonstrate its proper operation to the engineer when requested by the engineer.

B. No equipment shall be tested, or operated for any purpose until it has been fully prepared and made ready for normal operation. Damage to equipment occasioned by improper or ill-timed operation or testing shall be made good, at the contractor’s expense, before final inspection and acceptance.

3.05 TRAINING

A. Contractor shall furnish, without additional expense to the owner, the services of competent instructions, who will give full instruction in the care, adjustment, and operation and maintenance of parts of the mechanical equipment to the owner's permanent employees who are to have charge of the equipment. Provide a minimum of one man-week (40 hours) of instruction for mechanical equipment. See individual sections for additional training requirements for special systems.

B. Each instructor shall be thoroughly familiar with all parts of the equipment on which instructions are to be given and shall be trained in operating theory as well as in practical operation and maintenance work. Factory trained instructors shall be employed where they are available. Instruction shall be given during regular work week and at a time just prior to the time the equipment is accepted and turned over to the owner for regular operation.

C. All training and operating instructions shall be audio and video recorded by the contractor and the recording media handed over to the owner.

D. Contractor shall submit to the Architect/Engineer, a letter, signed by the owner, stating that the instruction of operating personnel has been completed and is accepted by the owner.

3.06 MATERIAL AND WORKMANSHIP

A. All materials and equipment shall be new and best quality, of the type best suited for the purpose intended, conform to the requirements of local and state codes governing the work involved, and be made by nationally recognized and substantially established manufacturers. The type and weight of material shall conform to the requirements of the latest standard specifications of the ASTM for that particular material. The Engineer reserves the right to reject material or workmanship not in accordance with the Specifications, either before or after installation. Contractor will be held responsible for defects in the material and workmanship which may appear during guarantee period after the building has been accepted. Such defects must be repaired or defective material replaced by the contractor at no expense to the owner.

B. No asbestos, hazardous, or PCB containing materials of any type shall be used on this project.

C. All piping, ductwork and equipment in finished areas shall be furnished and installed to present a neat and clean appearance. All surfaces except pipe and duct that are to receive paint by General Contractor shall have a factory applied prime coat. All items that are to have finished paint by Mechanical Contractor shall have color selected by Architect/Engineer.

D. The contractor shall be responsible for the proper installation of all systems in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials for a period of 12 months from substantial completion.

3.07 JOB SITE CONDITIONS

A. All construction debris generated by the furnishing and installing of mechanical equipment and systems shall be removed in a timely manner to prevent obstruction of other trades. Cartons, construction debris, piping, etc. shall be removed and the area brought to a "broom clean" finish.

B. Whenever permanent heating equipment is to be utilized for the temporary construction heating, it shall be maintained in a clean condition. The HVAC Contractor shall be responsible to check the unit at start-up and shall install all necessary filters. The General Contractor shall take normal precautions in job site cleanliness and the HVAC Contractor shall periodically inspect the equipment for accumulations of dust and debris. If it is determined that the General Contractor is not maintaining clean conditions throughout the site to the point of possible harm to the equipment, then the HVAC Contractor shall immediately contact the General Contractor and Architect/Engineer for resolution. The permanent heating equipment shall be turned off if resolution cannot be achieved.

C. At the completion of the work, this Contractor shall remove all rubbish caused by his work from the premises and shall thoroughly clean all equipment piping and ductwork that was installed as part of this contract.

3.08 CLOSEOUT ACTIVITIES

A. Refer to Division 1 specifications for closeout submittals and any demonstration and training requirements.

END OF SECTION

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct systems, equipment, and related components.

1.02 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.
   1. Above-ceiling plenum for supply air is not required to be cleaned.
   2. Above-ceiling plenum for return air is not required to be cleaned.
   3. Makeup air system is required to be cleaned.
   4. Exhaust-only system is required to be cleaned.

B. ACAC: American Council for Accredited Certification.

C. AIHA-LAP: American Industrial Hygiene Association Lab Accreditation Program

D. ASCS: Air systems cleaning specialist.

E. CESB: Council of Engineering and Scientific Specialty Boards.

F. CMI: Certified Microbial Investigator.

G. CMC: Certified Microbial Consultant

H. CMR: Certified Microbial Remediator.

I. CMRS: Certified Microbial Remediation Supervisor.

J. EMLAP: Environmental Microbiology Laboratory Accreditation Program.

K. IEP: Indoor Environmental Professional.

L. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.

M. NADCA: National Air Duct Cleaners Association.

1.03 REFERENCE STANDARDS

A. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

C. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.05 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. ASCS Qualifications: A certified member of NADCA.
   a. Certification: Employ an ASCS certified by NADCA on a full-time basis.
   b. Supervisor Qualifications: Certified as an ASCS by NADCA.
2. IEP Qualifications: CMI who is certified by ACAC and accredited by CESB.
3. IEP Qualifications: CMC who is certified by ACAC and accredited by CESB.
4. CMR Qualifications: Certified by ACAC and accredited by CESB.
5. CMRS Qualifications: Certified by ACAC and accredited by CESB.

B. Testing and Inspection Agency Qualifications: Experienced in inspection and testing using methods defined in NADCA ACR.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

2.03 HVAC CLEANING AGENTS

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. Apex Engineering Products Corporation.
   2. BBJ Environmental Solutions.
   3. Goodway Technologies Corporation.
   4. Nu-Calgon.
   5. QuestVapco Corporation.

B. Description:
   1. Formulated for each specific soiled coil condition that needs remedy.

2.04 ANTIMICROBIAL SURFACE TREATMENT

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. Bio-Cide International, Inc.
   2. Contec, Inc.
   3. Ecolab, Inc.

B. Description: Specific product selected shall be as recommended by the IEP based on the specific antimicrobial needs of the specific Project conditions.
   1. Formulated to kill and inhibit growth of microorganisms.
   2. EPA-registered for use in HVAC systems and for the specific application in which it will be used.

3. Have no residual action after drying, with zero VOC off-gassing.
4. OSHA compliant.
5. Treatment shall dry clear to allow continued visual observation of the treated surface.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Obtain Owner's approval of proposed temporary locations for large equipment.

F. Designate a decontamination area and obtain Owner's approval.

G. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

H. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.

3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.
   1. Source-Removal Cleaning Methods:
      a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
      b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.
   2. Cleaning Mineral-Fiber Insulation Components:
      a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
      b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
      c. Fibrous materials that become wet shall be discarded and replaced.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.
   1. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing coil cleaning verification.
   2. Coil drain pans shall be subject to NADCA ACR, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
   3. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
   4. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations.
   5. Rinse thoroughly with clean water to remove any latent residues.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

1. Particulate Collection: For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

I. Control odors and mist vapors during the cleaning and restoration process.

J. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.
1. Replace damaged insulation according to Section 23 0713 "Duct Insulation."

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

F. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. When directed, re-clean components until they pass.

E. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

F. Prepare a written cleanliness verification report.

3.07 ANTI-MICROBIAL TREATMENT

A. Apply antimicrobial agents and coatings if active fungal growth is determined by the IEP to be at Condition 2 or Condition 3 status according to IICRC S520, as analyzed by a laboratory accredited by AIHA-LAP with an EMLAP certificate, and with results interpreted by an IEP. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch (0.1524 mm) thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Sleeves.
   5. Escutcheons.
   6. Floor plates.
   7. Grout.
   8. Equipment installation requirements common to equipment sections.
   9. Concrete bases.
   10. Supports and anchorages.

B. Related Sections:
   1. Division 01 Section “Project Management and Coordination” for requirements related to each subcontractor’s responsibility to complete coordination drawings and submit.
   2. Division 01 Section “Closeout Submittals” for requirements related to each sub contractor’s responsibility to submit record drawing to the owner as part of the operation and maintenance data.

1.02 DEFINITIONS

A. Refer to General Conditions for additional definitions.

B. 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, crawlspaces, and tunnels.

C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

F. 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.

1.03 SUBMITTALS

A. Shop Drawings: CAD generated drawings and drawn to 1/8 inch equals 1 foot scale. The common/public areas and the entire mechanical room shall require CAD generated drawings and drawn to 1/4 inch equals 1 foot scale. The following components shall be noted on the drawing for the purpose of coordination with other trades and based on input from installers of the items involved:
   1. Duct layout indicating sizes.
   2. Elevations of top and bottom of ducts.
   3. Penetrations through fire-rated and other partitions.
   4. Equipment installation based on equipment being used on Project.

5. Duct accessories, including access doors and panels.

B. Welding certificates.

1.04 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.

1.05 COORDINATION

A. This Contractor shall coordinate with other trades in the installation of equipment, piping, conduit, and ductwork.

B. The HVAC/ Sheet-Metal Contractor shall initiate the coordination process by providing reproducible plan drawings showing ductwork and equipment. The HVAC/Sheet-Metal Contractor shall forward the drawings to the Piping Contractor, Fire Protection Contractor, and Electrical Contractor for inclusion of their systems work. The HVAC/Sheet-Metal Contractor shall be responsible for retrieving all drawings from necessary contractors and developing necessary drawings highlighting conflicting areas.

C. Following the completion of these drawings, an on-site coordination meeting shall be convened, and attended by all the above contractors, and the Mechanical and Electrical design Engineers for the purpose of review and coordination. This meeting allows the opportunity for all contractors to resolve coordination issues prior to the fabrication and installation of materials. Coordination meeting shall take place before any work is started. No additional cost to the project will be accepted for any coordination related items if this process is not adhered to.

1.06 PREFARICATION

A. If a contractor elects to prefabricate piping and ductwork, they are still obligated to abide by all requirements for cooperation with other trades. they shall not assume that his material will be installed first and other trades must follow.

B. If changes are made by the architect/engineer reasonably in advance of anticipated installation, the Owner shall not be penalized with added cost because materials were prefabricated in advance.

PART 2 PRODUCTS

2.01 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.

2.02 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, 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 or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.03 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.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

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: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: glass reinforced nylon or plastic Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 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.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 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. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated and rough brass.

2.07 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.08 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.

PART 3 EXECUTION

3.01 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. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 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.

I. Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. 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.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 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.

3.04 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.

3.05 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 "Cast-in-Place Concrete."

3.06 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 HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC 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.

3.08 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.09 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:
   1. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
      a. Extend sleeves 2 inches above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
   3. Sleeves for Piping Passing through Gypsum-Board Partitions:
      a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
      b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
      c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
   4. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
   5. Sleeves for Piping Passing through Exterior Concrete Walls:
      a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
      b. Cast-iron wall-pipe sleeves for pipes NPS 6 and larger.

c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

6. Sleeves for Piping Passing through Interior Concrete Walls:
   a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
   b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.

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 for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.10 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

C. Escutcheons for New Piping:
   1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
   2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
   5. Bare Piping in Equipment Rooms: One piece, cast brass.
   6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.11 FLOOR PLATE INSTALLATION

A. Install floor plates for piping penetrations of equipment-room floors.

B. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. New Piping: One-piece, floor-plate type.

3.12 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. Protect grout from disturbances during curing.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Single phase electric motors.

C. Three phase electric motors.

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. 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.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Comply with requirements in this section except when stricter requirements are specified in HVAC equipment schedules or other Sections.

B. Nominal Efficiency:
   1. Comply with ASHRAE 90.1, current version.

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F (40 degrees C) environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.
   4. 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.

D. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor.

F. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.03 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

E. Service Factor: 1.15.

F. Insulation System: NEMA Class F or better.

G. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

H. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

I. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

J. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

K. Sound Power Levels: To NEMA MG 00001.

L. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

M. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. 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.

O. 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 H insulation.
   4. All motors shall be provided with manufacturer installed shaft grounding kit.

END OF SECTION

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SECTION 23 05 16
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

1.04 SUBMITTALS

A. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

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.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Maintenance Data: Include adjustment instructions.

E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Single braided, stainless steel.

C. Pressure Rating: 125 psi up to 12 inch (862 kPa up to 300 mm, DN).

D. Maximum Service Temperature: 450 degrees F (232 degrees C).

E. End Connections: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch (20 mm) on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 125 psi up to 2 inch (862 kPa up to 50 mm, DN).

D. Maximum Service Temperature: 450 degrees F (232 degrees C).

E. End Connections: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch (20 mm) on each side of installed center line.

H. Application: Copper piping.

2.03 EXPANSION JOINTS - METAL BELLOWS TYPE

A. Provide shroud to protect from external damage and allows for the application of external insulation.

B. Provide with tie rods to prevent over-compression or over-elongation.

C. Pressure Rating: 125 psi and 400 degrees F (862 kPa and 204 degrees C).

D. Maximum Compression: 1-3/4 inches (45 mm).

E. Maximum Extension: 1/4 inch (6 mm).

F. End Connections: Flanged.

G. Size: Use pipe sized units.

H. Application: Steel piping 2 inches (50 mm) and larger.

2.04 EXPANSION JOINTS - HOSE AND BRAID

A. Manufacturers:
   1. Flex-Hose Co. Inc; V-Loop: www.flexhose.com/#sle.
   2. Flex-Weld, Inc; Keflex Ke-Loop: www.kelcoind.com/#sle.
   3. The Metraflex Company; Metraloop: www.metraflex.com/#sle.
   4. Unisource Manufacturing, Inc; V-Loop: www.unisource-mfg.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.

C. Maximum Allowable Motion: 2 inch (50.8 mm) in the x, y, and z planes with no thrust loads to the building structure

D. Maximum Working Pressure: 150 psi (1030 kPa) at 800 degrees F (426.7 degrees C).

E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment
   1. Selected Product to Accommodate:
      a. Compression and Expansion Axial Deflection: +/- 6 inch (150 mm).
      b. Seismic Deflection: +/- 4 inch (100 mm)
      c. Angular Rotation: 15 degrees.

d. Force developed by 1.5 times specified maximum allowable operating pressure.

2. Provide necessary accessories including, but not limited to, swivel joints.

2.05 ACCESSORIES

A. Pipe Alignment Guides:
   1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch (25 mm) thick insulation, minimum 3 inches (75 mm) travel.

B. Pipe Anchors:
   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

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

C. Install one guide(s) on each side of pipe expansion loops. Locate guides at a distance of twice the amount of offset, from the center of the loop.

D. Locate guides on both sides of expansion joint, not more than four pipe diameters from expansion joint.

E. Attach guides to pipe and secure guides to building structure.

F. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

G. 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.

H. 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.

I. 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.

END OF SECTION

SECTION 23 05 17
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

A. Section 23 05 23 - General-Duty Valves for HVAC Piping.

B. Section 23 07 19 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

1.04 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
   1. Plastic pipe within ceiling plenums shall meet ASTM E84 flame spread and smoke development.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Schedule 40 PVC.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
4. Garlock; LINK-SEAL: www.garlock.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Modular Mechanical Sleeve-Seal:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
a. Corrosion resistant.
b. Underground, buried, and high level of water-resistance.
5. EPDM seal element.
6. Reinforced nylon polymer pressure plates.
7. 316 stainless steel nuts and bolts.

C. Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
a. Pack solid using mineral fiber in compliance with ASTM C592.
b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight or mechanically expandable chloroprene inserts with mastic-sealed components.

E. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.

6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION

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SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flow meters.

B. Electromagnetic flow meters.

C. Pressure gauges and pressure gauge taps.

D. Thermometers and thermometer wells.

E. Test plugs.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 LIQUID FLOW METERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. McCrometer: www.mccrometer.com/#sle.
   3. Veris Industries: www.veris.com/#sle.

B. Calibrated ASME MFC-3M Venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gauge in case.

C. Annular element flow stations with meter set.
   1. Measuring Station: Type 316 stainless steel pitot type flow element installed in threaded nipple pipe section, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
      a. Pressure rating: 275 psi (1896 kPa).
      b. Maximum temperature: 400 degrees F (204 degrees C).

c. Accuracy: Plus 0.55 percent to minus 2.30 percent.

2.02 ELECTROMAGNETIC FLOW METERS

A. Manufacturers:
1. Badger Meter, Inc: www.badgermeter.com/#sle.
2. Foxboro, a brand of Schneider Electric: www.schneider-electric.us/#sle.
3. Onicon, Inc; FT-3000 Series: www.onicon.com/#sle.

B. Inline Type: Class 150 flanged with hard rubber liner, 1 inch (25 mm, DN) and larger.

C. Liquid Flow Capacity Range: As indicated on drawings.

D. Construction: Stainless steel or aluminum sensor with integral NEMA EN 10250 Type 4 or 4X stainless steel or aluminum enclosure to hold thermal mass sensor and circuits with numeric display for consumption reading.

E. Accuracy: 0.02 percent of value applied to manufacturer-specified velocity range.

F. Output: Two-wire, 0 to 10 VDC, non-loop powered.

G. Service Pressure and Temperature: Up to 400 psi (27.6 bar) and 15 to 250 degrees F (minus 9.4 to 125.6 degrees C) liquid side, 150 degrees F (65.5 degrees C) ambient.

2.03 PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
3. Omega Engineering, Inc: www.omega.com/#sle.
4. Watts Regulator Company; www.watts.com.
5. Weiss Instruments, Inc.; www.weissinstruments.com
6. Winters Instruments: www.winters.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
1. Case: Liquid-filled type(s); cast aluminum or drawn steel..
2. Size: 4-1/2 inch (115 mm) diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. ressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass or acrylic plastic.
9. Ring: Stainless steel.
10. Mid-Scale Accuracy: One percent.
11. Scale: Psi and KPa.

2.04 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

B. Needle Valve: Brass, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) connections.

D. Syphon: Steel, Schedule 40, 1/4 inch (6 mm) angle or straight pattern.

2.05 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
   4. Weiss Instruments, Inc.; www.weissinstruments.com
   5. Winters Instruments: www.winters.com/#sle.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch (225 mm) scale.
   2. Window: Clear glass or acrylic plastic.
   3. Stem: Aluminum, brass or 304 stainless steel of length suitable for installation.
   4. Tube Background: Nonreflective aluminum with permanently etched scale markings.
   5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
   6. Accuracy: 2 percent, per ASTM E77.
   7. Calibration: Degrees F.

2.06 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 or CSA.
   5. Type: Stepped shank unless straight or tapered shank is indicated.
   6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
   7. Internal Threads: 1/2, 3/4, and 1 inch, 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.

2.07 TEST PLUGS

A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch (60 mm) diameter pressure gauges, one gauge adapters with 1/8 inch (3 mm) probes, two 1 inch (25 mm) dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets.

E. Fill thermowells with heat-transfer medium.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.02 APPLICATION

A. Provide pressure gauges in the following locations:
1. On the branch piping to the expansion tank. +/-2% accuracy.
2. One pressure gauge per pump, installing taps before strainers, on suction diffuser, on discharge of pump, and at balancing valve/triple duty valve. Pipe to gauge.
3. On inlet and outlet piping to each boiler, chiller and cooling tower.
4. On inlet and outlet piping to each system-level hydronic coil.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Where indicated on drawings.

B. Provide thermometers in the following locations, with indicated scale ranges:
1. Two inlets and two outlets of each hydronic heat exchanger. Liquid-in-glass; 30°F to 240 deg. F.
2. On inlet and outlet piping to each system-level hydronic coil. Liquid-in-glass; 30°F to 240°F.
3. Inlet and outlet of each thermal-storage tank. Liquid-in-glass; 30°F to 240°F.
4. Where indicated on drawings.

C. Provide test plugs in the following locations:
1. On inlet and outlet piping to each zone-level hydronic coil.
2. Where indicated on drawings.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Angle valves.
B. Globe valves.
C. Ball valves.
D. Butterfly valves.
E. Check valves.
F. Gate valves.
G. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
B. Section 23 07 19 - HVAC Piping Insulation.
C. Section 23 21 13 - Hydronic Piping.

1.03 ABBREVIATIONS AND ACRONYMS

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. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. TFE: Tetrafluoroethylene.
I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
K. AWWA C606 - Grooved and Shouldered Joints; 2022.
L. MSS SP-67 - Butterfly Valves; 2022.
M. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.
N. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
O. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
P. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
Q. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
R. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.05 SUBMITTALS

A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.
B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
C. 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.
D. Provide the following valves for the applications if not indicated on drawings:
    1. Throttling (Hydronic): Butterfly and Ball
    2. Isolation (Shutoff): Butterfly, Gate, and Ball.
    3. Swing Check (Pump Outlet):
        a. Size 2 inch (50 mm, DN) and Smaller: Bronze with bronze disc.
        b. Size 2-1/2 inch (65 mm, DN) and Larger: Iron with lever and weight or lever and spring.
E. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
F. Required Valve End Connections for Non-Wafer Types:
    1. Steel Pipe:
        a. Size 2 inch (50 mm, DN) and Smaller: Threaded ends.
        b. Size 2-1/2 inch (65 mm, DN) and Larger: Grooved ends.
    2. Copper Tube:
        a. Size 2 inch (50 mm, DN) and Smaller: Threaded ends, except solder-joint valve-ends.
        b. Size 2-1/2 inch (65 mm, DN) and Larger: Grooved ends.
    3. Steam and Steam Condensate Pipe: Grooved ends not acceptable.
G. Heating Hot Water Valves:
    1. Size 2 inch (50 mm, DN) and Smaller, Bronze Valves:
        a. Threaded ends.

b. Ball: Full port, two piece, bronze trim.
c. Swing Check: Bronze disc, Class 125.

2. Size 2-1/2 inch (65 mm, DN) and Larger, Iron Valves:
   a. 2-1/2 inch (65 mm, DN) to 3 inch (75 mm, DN): Threaded ends.
   b. Ball: 2-1/2 inch (65 mm, DN) to 3 inch (75 mm, DN), Class 150.
   c. Single-Flange Butterfly: 4 inch (100 mm, DN) to 12 inch (300 mm, DN), stainless steel disc, EPDM seat, 200 CWP.
   d. Single-Flange Butterfly: 14 inch (350 mm, DN) to 24 inch (600 mm, DN), stainless steel disc, EPDM seat, 150 CWP.
   e. Grooved-End Butterfly: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), 175 CWP.
   f. Butterfly: High performance, single flange, Class 150.
   g. Swing Check: Metal seats, Class 125.
   h. Swing Check: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), lever and spring closure control, Class 125.
   i. Grooved-End Swing Check: 3 inch (80 mm, DN) to 12 inch (300 mm, DN), 300 CWP.
   j. Plate-Type Check: Single plate, metal seat, Class 125 .

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Gear Actuator: Quarter-turn valves 8 inch (200 mm, DN) and larger.
   2. Handwheel: Valves other than quarter-turn types.
   3. Hand Lever: Quarter-turn valves 6 inch (150 mm, DN) and smaller.

D. Valves in Insulated Piping: Provide 2 inch (50 mm, DN) stem extensions and the following features:
   1. Gate Valves: Rising stem.
   2. Ball Valves: 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: Extended neck.
   4. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Pipe Flanges and Flanged Fittings 1/2 inch (15 mm, DN) through 24 inch (600 mm, DN): ASME B16.5.
   4. Solder Joint Connections: ASME B16.18.
   5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:
   1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
   2. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:
   1. Fabricate from dezincification resistant material.

2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Manufacturers:
1. American Valve, Inc.
2. Apollo Valves.
3. Crane Co.; Crane Valve Group; Crane Valves.
4. Crane Co.; Crane Valve Group; Jenkins Valves.
5. Crane Co.; Crane Valve Group; Stockham Division.
6. FNW.
7. Hammond Valve.
8. Kitz Corporation.
9. Milwaukee Valve Company.
10. NIBCO INC.
11. Powell Valves.Watts Regulator Co.; a division of Watts Water Technologies, Inc.
12. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2.03 BRONZE, GLOBE VALVES

A. Ratings for Class 125 and Class 250:
1. Class 125:
a. WOG Rating: 200 psi (1,380 kPa).
b. WSP Rating: 125 psi (861.8 kPa), saturated.
2. Class 250: WOG Rating; 300 psi (2,070 kPa).
3. Comply with MSS SP-80, Type 1.
4. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
5. End Connections: Threaded or solder.
6. Bonnet: NRS; Nonrising Stem.
7. Nonrising Stem: Bronze.
8. Disc: PTFE.
9. Packing: Asbestos free.
10. Handwheel Operator: Malleable Iron.

2.04 BRASS, BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim and Female Thread, Male thread, or Solder Connections:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psi (1,035 kPa).
3. WOG Rating: 600 psi (4,140 kPa).
4. Vacuum Rating: 28.9 in-Hg (97.9 kPa).
5. Body: Forged brass.
6. Seats: PTFE.
7. Stem: Stainless Steel.
8. Ball: Chrome-plated brass.

2.05 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze or Brass Trim:
1. Comply with MSS SP-110.

2. WSP Rating: 150 psi (1,035 kPa).
3. WOG Rating: 400 psi (2,758 kPa).
4. Body: Forged bronze or dezincified-brass alloy.
5. End Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze or brass.
8. Ball: Chrome plated brass.

2.06 IRON, BALL VALVES

A. Split Body, Full Port:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psi (1380 kPa).
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Wafer and Lug Style:
1. Comply with MSS SP-67, Type I.
2. Wafer Style, CWP Ratings:
   a. Sizes 2 to 12 inch (50 to 300 mm, DN): 200 psi (1380 kPa).
   b. Sizes 14 to 24 inch (350 to 600 mm, DN): 150 psi (1034 kPa).
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Stainless steel.

2.08 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psi (1200 kPa).
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.09 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type; Bidirectional dead end service without downstream flange:
1. Comply with MSS SP-68.
2. Class 150: CWP Rating: 285 psi (1,965 kPa) at 100 degrees F (38 degrees C).
3. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
4. Seat: Metal or reinforced PTFE.
5. Offset stem: Stainless steel.
6. Disc: Carbon steel.

2.10 BRASS, HORIZONTAL SWING CHECK VALVES

A. Threaded End-Connections:
1. Class 125: CWP Rating: 200 psi (1,380 kPa).
2. Body: Forged brass.

3. Disc: Forged brass.
4. Hinge-Pin, Screw, and Cap: Forged brass.

2.11 BRONZE, SWING CHECK VALVES

A. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WSP Rating: 200 psi (1,380 kPa).
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded or soldered.
6. Disc: Bronze.

2.12 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. Sizes 2-1/2 to 12 inch (65 to 300 mm, DN): CWP Rating; 200 psi (1,380 kPa).
3. Sizes 14 to 24 inch (350 to 600 mm, DN): CWP Rating; 150 psi (1,035 kPa).
4. Body Design: Clear or full waterway.
5. Body Material: ASTM A126, gray iron with bolted bonnet.
6. Ends: Flanged.
7. Trim: Bronze.
8. Gasket: Asbestos free.
9. Closer Control: Factory installed, exterior lever, and spring or weight.

2.13 IRON, GROOVED-END SWING CHECK VALVES

A. Class 300:
1. CWP Rating: 300 psi (2,070 kPa).
2. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM or Nitrile.
4. Disc: Ductile iron.
5. Coating: Black, non-lead paint.

2.14 IRON, GATE VALVES

A. NRS:
1. Comply with MSS SP-70, Type I.
2. Class 125:
   a. Sizes 2-1/2 to 12 inch (65 to 300 mm, DN), CWP Rating; 200 psi (1,380 kPa).
   b. Sizes 14 to 24 inch (350 to 60 mm, DN), CWP Rating; 500 psi (3,450 kPa).
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open. Examine guides and seats made accessible by such operations.

C. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion.

D. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material.

F. Should valve is determined to be defective, replace with new valve. Do not attempt to repair defective valves.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Locate valves for easy access. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install valves in horizontal piping where practical, with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

F. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.
   2. Orient plate-type into horizontal or vertical position, between flanges.

3.03 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.

END OF SECTION

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

B. Pipe insulation shields.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

O. UL (DIR) - Online Certifications Directory; Current Edition.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.15. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Strut Channel or Bracket Material:
    a. Indoor Dry Locations: Use galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
2. Minimum Channel Thickness: Steel sheet, 14 gauge, 0.0747 inch (1.90 mm).
3. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 1-5/8 inch (41 mm) height.
4. Accessories: Provide bracket covers, clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

D. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

E. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch (13 mm) diameter.
    b. Piping up to 1 inch (25 mm, DN): 1/4 inch (6 mm) diameter.
    c. Piping larger than 1 inch (25 mm, DN): 3/8 inch (10 mm) diameter.
    d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

F. Cable Hanging System Kits:
1. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb (54.4 kg).

G. Thermal Insulated Pipe Supports:
1. General Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.

c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch (15 to 750 mm, DN) iron pipes.
d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.

2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil (1.524 mm).
   d. PVC is not allowed within return air ceiling plenums.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

H. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F (50 degrees C):
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

I. Roller Chairs:
1. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
2. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
3. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

J. Pipe Stanchions:
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

K. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

L. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
   5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch (15 to 200 mm, DN).

M. U-Bolts:
   1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

N. Strut Clamps:
   1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
   2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil (26,398,000 V/m).

O. Insulation Clamps:
   1. Two bolt-type clamps designed for installation under insulation.
   2. Material: Carbon steel with epoxy copper or zinc finish.

P. Pipe Hangers:
   1. Split Ring Hangers:
      a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
      b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
      c. Provide hanger rod and nuts of the same type and material for a given pipe run.
      d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
   2. Band Hangers, Adjustable:
      a. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   3. J-Hangers, Adjustable:
      a. MSS SP-58 Type 5, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   4. Swivel Ring Hangers, Adjustable:
      a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.
      b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
      c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.
   5. Clevis Hangers, Adjustable:
      a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
      b. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
      c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.

Q. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

R. Pipe Shields for Insulated Piping:

1. General Construction and Requirements:
    a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
    b. Shields Material: UV-resistant polypropylene with glass fill.
    c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
    d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
    e. Maximum Service Temperature: 178 degrees F (81 degrees C).
    f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

S. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

T. Pipe Installation Accessories:
1. Seismic Bracing Hardware:
    a. Cable Suspension Systems:
        1) Strut channel or bracket-fitted fitting with locking mechanism for pipe or equipment suspension using cable wires extended to surface-mounted end-fixing fittings.
        2) Provide cable wire and end-fixing as required to hold minimum weight of 120 lb (54.4 kg).
    b. Cable Sway Bracing Systems:
        1) Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
        2) Provide cable wire and end-fixing as required to hold minimum weight of 25 lb (11.3 kg).

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments to properly support piping from the building structure.

B. Install products in accordance with manufacturer's instructions.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. 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. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

E. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. 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.

H. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

I. Unless specifically indicated or approved by Structural Engineer, do not provide support from roof deck.

J. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

K. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

L. Insulated Piping:
   1. Install hanger rods with enough adjustment to support piping before and after insulating.
   2. Piping Operating above Ambient Air Temperature: Clamps and hangers may project through insulation, with sealed ends of insulation butting up to clamps and hangers.
   3. Piping Operating below Ambient Air Temperature:
      a. Size hangers for outer circumference of pipe insulation.
      b. Use high density full circumference insulation inserts and full circumference shields at hangers supporting insulated piping 2” and larger.
      c. Use MSS MSS Type 39 carbon steel insulation saddle and insulation inserts to support piping 4” and larger. Use pipe roller supports for supporting saddles.
      d. Use plastic coated riser clamps for vertical pipe applications. Insulate the riser clamp and provide vapor barrier mastic to insulated clamp.
      e. Use plastic coated pipe clamps for pipe anchors, where anchors are indicated. Insulate the pipe and clamp and provide vapor barrier mastic to insulated clamp.
   4. Install MSS SP-58, Type 40 protective metal shield at each support.
      a. Shield Dimensions for Pipe: Not less than the following:
         1) NPS 1/2 to NPS 3: 12 inches long and 0.048 inch thick.
         2) NPS 4: 12 inches long and 0.06 inch thick.
         3) NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
         4) NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
         5) NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
   5. Pipes NPS 4 and Larger: Unless carbon steel saddle and rollers are provided, include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

M. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 30 00.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

N. Secure fasteners according to manufacturer's recommended torque settings.

O. Remove temporary supports.

3.02 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.

3.03 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 carbon-steel pipe hangers and supports and attachments for general service applications.

E. Use padded hangers for non-metallic piping.

F. Use thermal-hanger shield inserts for insulated piping and tubing.

G. 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.

H. 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.

I. 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.

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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION

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SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

G. Vibration-isolated and/or seismically engineered roof curbs.

H. In-curb sound attenuation treatment.

I. Vibration isolator system types.

J. Seismic isolator system types.

1.02 RELATED REQUIREMENTS

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.03 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

C. Life Safety Systems:
   1. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
   2. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
   3. All medical and life support systems.
   4. All life safety equipment has an asterisk on the equipment schedule.

D. Positive Attachment:
   1. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.

E. Transverse Bracing:
   1. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.

2. Longitudinal Bracing:
    a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

E. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2014.

F. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

G. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

H. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

K. MFMA-4 - Metal Framing Standards Publication; 2004.

L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
    1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
    2. Coordinate the work with other trades to provide additional framing and materials required for installation.
    3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
    4. Seismic Controls:
        a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
        b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
    5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
    1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SCOPE OF WORK

A. The work in this section includes, but is not limited to the following:
    1. Vibration isolation for piping, ductwork and equipment.
    2. Equipment isolation bases.

3. Flexible piping connections.
4. Resilient Pipe Anchors and Guides

B. The work in this section includes, but is not limited to the following for seismic:
1. Vibration isolation for piping, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic attachment of housekeeping pads.
7. Certification of seismic restraint designs and installation supervision.
8. All mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).

AC Units	Chillers	Fans	Tanks
Air Distribution	Compressors	Generators	Transformers
Air Handling Units	Computer Room Units	Heat Exchangers	Unit Heaters
Air Separators	Condensers	Light Fixtures	Unit Substations
Battery Racks	Condensing Units	Motor Control Centers	VFD/VFC
Boilers	Conduit	Piping	Water Heaters
Bus Ducts	Cooling Towers	Pumps	
Cabinet Unit Heaters	Ductwork	Rooftop Units	
Cable Trays	Electrical Panels	Switch Gear	

1.07 SUBMITTALS

A. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

C. Shop Drawings - Vibration Isolation Systems:
1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

D. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
2. Identify mounting conditions required for equipment seismic qualification.
3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
4. Indicate proposed arrangement of distributed system trapeze support groupings.
5. Indicate proposed locations for distributed system flexible fittings and/or connections.

6. Indicate locations of seismic separations where applicable.
7. Include point load drawings indicating design loads transmitted to structure at each attachment location.

E. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed HVAC components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
a. Component operating weight and center of gravity.
b. Component elevation in the building in relation to the roof elevation (z/h).
c. Component importance factor (Ip).
d. For distributed systems, component materials and connection methods.
e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
g. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
h. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45E to the weakest mode.
i. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

F. Certification for seismically qualified equipment; identify basis for certification.

G. In-Curb Sound Attenuation Treatment: Provide acoustic test data indicating characteristics of sound absorption and transmission loss through testing in accordance with ASTM E90.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer’s detailed field testing and inspection procedures.

M. Field quality control test reports.

1.08 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.09 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and locations as scheduled or specified.
   2. Provide seismic restraints and locations as scheduled or specified.
   3. Provide calculations and materials if required for restraint of unisolated equipment.
   4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.10 RELATED WORK

A. Housekeeping Pads:
   1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
   2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel:
   1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments:
   1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirments of the vibration vendor's calculations.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch (50 mm) operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.
      b. Located within 50 feet (15.2 m) of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
      c. For piping over 2 inch (50 mm) located below or within 50 feet (15.2 m) of noise-sensitive areas indicated.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch (50 mm) deflection required.
      b. Remainder of Supports: 0.75 inch (19 mm) deflection unless otherwise indicated.
   3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
   5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
   6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
   7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

F. Thrust Restraint Applications:
   1. Use thrust restraints to resist horizontal motion due to thrust for fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2.0 inches wg (0.5 kPa) or greater total static pressure.
   2. Minimum Static Deflection: Same as static deflection of equipment.
   3. Limit lateral movement to 0.25 inch (6 mm) or less unless otherwise indicated.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide HVAC component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC components.

B. Seismic Design Criteria: ICC (IBC).

1. Seismic Design Category: C.
2. Risk Category: _____.

C. Component Importance Factor (Ip): HVAC components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
   1. HVAC components required to function for life safety purposes after an earthquake.
   2. HVAC components that support or otherwise contain hazardous substances.

D. Seismic Qualification of Equipment:
   1. Provide special certification for HVAC equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
   2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
   3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
   4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Premanufactured Modular HVAC Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet (1.8 m) high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

F. Seismic Restraints:
   1. Provide seismic restraints for HVAC components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
   2. Seismic Restraint Exemptions:
      a. Exemptions for Seismic Design Category C:
         1) HVAC components where either of the following apply:
            (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
            (b) The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less.
         2) HVAC piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch (50 mm) or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
      b. Duct System Exemptions, All Seismic Design Categories:
         1) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control with component importance factor (Ip) of 1.0, where flexible connections or other assemblies are provided between duct system and associated components, where duct system is positively attached to the structure, and where one of the following apply:
            (a) Trapeze supported duct with trapeze assemblies using 3/8 inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds (445 N) or less.

(b) Trapeze supported duct with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds (890 N) or less.

(c) Trapeze supported duct with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 24 inches (610 mm) in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds (445 N) or less.

(d) Hanger supported duct with individual rod hangers 3/8 inch (10 mm) or 1/2 inch (13 mm) in diameter not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

2) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control, where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact, and where duct system is positively attached to the structure and has a cross sectional area of less than 6 square feet (0.557 sq m) and weighs 20 pounds per foot (292 N/m) or less.

c. HVAC Piping Exemptions, All Seismic Design Categories:

1) HVAC piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:

(a) Trapeze supported piping weighing less than 10 pounds per foot (146 N/m), where all pipes supported meet size requirements for exemption as single pipes described under specific seismic design category exemptions above.

(b) Trapeze supported piping with trapeze assemblies using 3/8 inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds (445 N) or less.

(c) Trapeze supported piping with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 200 pounds (890 N) or less.

(d) Trapeze supported piping with trapeze assemblies using 1/2 inch (13 mm) diameter rod hangers not exceeding 24 inches (610 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds (445 N) or less.

(e) Hanger supported piping with individual rod hangers 3/8 inch (10 mm) or 1/2 inch (13 mm) in diameter not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where pipe has a component importance factor (Ip) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds (220 N) or less.

3. Seismic Restraint Exemptions:
   a. Exemptions for Seismic Design Category C:
      1) HVAC components with component importance factor (Ip) of 1.0.
      2) HVAC piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch (50 mm) or less; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
   b. Ductwork Exemptions, All Seismic Design Categories:
      1) Ductwork not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control where any of the following apply:
         (a) Trapeze supported ductwork weighing less than 10 pounds per foot (146 N/m).
         (b) Hanger supported ductwork where each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support to the supporting structure; rod hangers, where used, to be equipped with swivels.
         (c) Ductwork having a cross sectional area of less than 6 square feet (0.557 sq m) or weighing 17 pounds per foot (248 N/m) or less, and where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact.
   c. HVAC Piping Exemptions, All Seismic Design Categories:
      1) Trapeze supported piping weighing less than 10 pounds per foot (146 N/m), where all pipes supported meet requirements for exemption as single pipes described under specific seismic design category exemptions above.
      2) Hanger supported piping where each hanger in the piping run is 12 inches (305 mm) or less in length from the pipe support to the supporting structure; rod hangers, where used, to be equipped with swivels.
4. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 412.
   c. FEMA 413.
   d. FEMA 414.
   e. FEMA E-74.
   f. SMACNA (SRM).
5. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
6. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
7. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).

b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

8. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated HVAC components, including distributed systems.
   c. Use only one restraint system type for a given HVAC component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC component weight.
   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
   h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
   i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
   j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.
9. Ductwork Applications:
   a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds (334 N).
   b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.

G. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
    a. Increase size of pad as required to comply with anchor requirements.
    b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

H. Seismic Interactions:
1. Include provisions to prevent seismic impact between HVAC components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
3. Comply with minimum clearance requirements between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

I. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
    a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.
    b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
    c. Design displacements at seismic separations.
    d. Anticipated drifts between floors.
2. Include provisions to prevent interruption of utility service due to seismic displacements.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
1. Vibration-Isolated Equipment Support Bases:
    a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
    b. Mason Industries: www.mason-ind.com/#sle.
    c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
    d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:
1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Centrifugal Fan Applications: Provide adjustable motor slide rails as required.
3. Maximum Deflection: 1 inch (25.4 mm).
4. Color code or otherwise identify springs to indicate load capacity.
5. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
6. Select springs to provide designed deflection of not less than 50 percent of specified deflection.

C. Vibration-Isolated Concrete Inertia Bases:
1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches (152 mm).

3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi (20 mPa) concrete in accordance with Section 03 30 00.
6. Centrifugal Fan Applications: Provide adjustable motor slide rails as required.
7. Pump Applications: Size and configure bases for piping elbow supports as required.

2.04 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
      d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.
   3. Seismic Snubbing Elements for Seismic Isolators:
      a. Air Gap: Between 0.125 inches (3 mm) and 0.25 inches (6 mm) unless otherwise indicated.
      b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch (6 mm) thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Nonseismic Applications:
   1. Resilient Material Isolator Pads:
      a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
      b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
      c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
   2. Resilient Material Isolator Mounts, Nonseismic:
      a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
   3. Open (Unhoused) Spring Isolators:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.

b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.

4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
9. Thrust Restraints:
   a. Description: Assembly utilizing free-standing, laterally stable steel spring designed for resisting horizontal motion due to thrust (e.g., air pressure from a fan), and intended for installation in pairs.

D. Vibration Isolators for Seismic Applications:
   1. Resilient Material Isolator Mounts, Seismic:

a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.

2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:
   1. External Seismic Snubber Assemblies:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
      d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
   2. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:
   1. Air Gap: Between 0.125 inches (3 mm) and 0.25 inches (6 mm) unless otherwise indicated.
   2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch (6 mm) thick; capable of being visually inspected for damage and replaced.

2.06 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
   1. Seismic Restraint Systems:
      a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      d. Mason Industries: www.mason-ind.com/#sle.
      e. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
   2. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.07 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:
   1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
      d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
   2. Source Limitations: Furnish vibration-isolated roof curbs and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration Isolation Curbs:
   1. Nonseismic Curb Rail:
      a. Location: Between
      b. Construction: Aluminum.
      c. Integral vibration isolation to comply with requirements of this section.
      d. Weather exposed components consist of corrosion resistant materials.
   2. Nonseismic Curb:

a. Location: Between structure and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to comply with requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.

3. Seismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Steel.
c. Integral vibration isolation to comply with requirements of this section.
d. Snubbers consist of minimum 0.25 inch (6 mm) thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
e. Weather exposed components consist of corrosion resistant materials.

C. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:
1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

2.08 VIBRATION ISOLATOR SYSTEM TYPES

A. Type "A":
1. Neoprene mountings shall have a minimum static deflection of 0.35”(9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Mountings shall be type ND or rails type RND as manufactured by Mason Industries, Inc.

B. Type "B":
1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4”(6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLF, as manufactured by Mason Industries, Inc.

C. Type "C":
1. Multiple bellow air springs shall be manufactured with powder coated upper and lower steel sections connected by a replaceable, flexible Nylon reinforced Neoprene element to achieve a maximum natural frequency of 3 Hz. (We have found 3 Hz adequate when using air springs. Should the specifying engineer require a lower frequency, change the 3 Hz to the lower number). Burst pressure must be a minimum of 3 times the published maximum operating pressure. All air spring systems shall be equipped with 3 leveling valves connected to the building control air or a supplementary air supply to maintain elevation plus or minus 1/8”(3mm). An air filter and water separator shall be installed before the air distribution system to the leveling valves. Submittals shall include natural frequency, as well as load and damping tests, all as performed by an independent lab or acoustician. Air springs shall be type MT and leveling valves type LV as manufactured by Mason Industries, Inc.

D. Type "D":

1. Equipment with large variations in the operating and installed weight, such as chillers, boilers, etc., and equipment exposed to the wind such as cooling towers, roof mounted fans and roof mounted air handling equipment shall be mounted on spring mountings, as described in Engineering Specification B, including the neoprene acoustical pad within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed and temporary steel spacers between the upper and lower housings. Housings shall serve as blocking during erection. When the equipment is at full operating weight, the springs shall be adjusted to assume the weight and the spacers removed, without changing the installed and operating heights. All restraining bolts shall have large rubber grommets to provide cushioning in the vertical as well as horizontal modes. The hole through the bushing shall be a minimum of 0.75”(19mm) larger in diameter than the restraining bolt. Horizontal clearance on the sides between the spring assembly and the housing shall be a minimum of 0.5”(13mm) to avoid bumping and interfering with the spring action. Vertical limit stops shall be out of contact during normal operation. Cooling tower mounts are to be located between the supporting steel and the roof or the grillage and dunnage as shown on the drawings when there is no provision for direct mounting. Housings and springs shall be powder coated and hardware electro-galvanized. Mountings shall be SLR or SLRSO as manufactured by Mason Industries, Inc.

E. Type "E":
1. Equipment with large variations in the operating and installed weight, such as chillers, boilers, etc., and equipment exposed to the wind such as cooling towers, roof mounted fans and roof mounted air handling equipment shall be mounted on air springs, as described in Engineering Specification C, but within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed and temporary steel spacers between the upper and lower housings. Housings shall serve as blocking during erection. When the equipment is at full operating weight, the air springs shall be pressurized to take the weight so the spacers can be removed without changing the installed and operating heights. All restraining bolts shall have large rubber grommets to provide cushioning in the vertical as well as the horizontal modes. The hole through the bushing shall be a minimum of 0.75”(19mm) larger in diameter than the restraining bolt. Horizontal clearance between the air spring assembly and the housing shall be a minimum of 0.5”(13mm) to avoid bumping and interference with the air spring action. Vertical limit stops shall be out of contact during normal operation. Mountings and air spring parts shall be powder coated. Hardware electro-galvanized. Air spring systems shall be connected to the building control air or a supplementary air supply and equipped with three leveling valves to maintain level within plus or minus 0.125”(3mm). Cooling tower mounts are to be located between the supporting steel and the roof or the grillage and dunnage as shown on the drawings when there is no provision for direct mounting. Mountings shall be SLR-MT and leveling valves type LV as manufactured by Mason Industries, Inc.

F. Type "F":

1. Hangers shall consist of rigid steel frames containing minimum 11/4”(32mm) thick LDS Rubber elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced LDS Rubber cup on the bottom. The LDS Rubber element and the cup shall have LDS Rubber bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the LDS Rubber element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30° capability. Hangers shall be type 30N as manufactured by Mason Industries, Inc.

G. Type "G":
   1. Hangers shall be as described in F, but they shall be precompressed and locked at the rated deflection by means of a steel precompression washer to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

H. Type "H":
   1. Hangers shall be manufactured with minimum characteristics as in Specification B, but without the LDS Rubber element. Springs are seated in a steel washer reinforced LDS Rubber cup that has a LDS Rubber bushing projecting through the bottom hole to prevent rod to hanger contact. Spring diameters and the lower hole sizes, shall be large enough to allow the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing.
   2. If ducts are suspended by flat strap iron, the hanger assembly shall be modified by the manufacturer with an eye on top of the box and on the bottom of the spring hanger rod to allow for bolting to the hanger straps. Submittals on either of the above hangers shall include a scale drawing of the hanger showing the 30° capability. Hangers for rods shall be Type 30 or for straps W30 as manufactured by Mason Industries, Inc.

I. Type "I":
   1. When total air thrust exceeds 10% of the isolated weight, floor mounted or suspended air handling equipment shall be protected against excessive displacement by the use of horizontal thrust restraints. The restraint shall consist of a modified Specification B spring mounting. Restraint springs shall have the same deflection as the isolator springs. The assembly shall be preset at the factory and fine tuned in the field to allow for a maximum of 1/4”(6mm) movement from stop to maximum thrust. 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. Restraints shall be attached at the center line of thrust and symmetrically on both sides of the unit. Horizontal thrust restraints shall be WB as manufactured by Mason Industries, Inc.

J. Type "J":

1. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14”(356mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1”(25mm). Bases shall be type WF as manufactured by Mason Industries, Inc.

K. Type "K":
1. Vibration isolation manufacturer shall provide steel members welded to height saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent distortion of equipment. Inverted saddles shall be type ICS, as manufactured by Mason Industries, Inc.

L. Type "L":
1. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating concrete bases. Bases for split case pumps shall be large enough to provide support for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6”(152mm). The base depth need not exceed 12”(305mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2”(13mm) bars welded in place on 6”(152mm) centers running both ways in a layer 1 1/2”(38mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1”(25mm) clearance below the base. Wooden formed bases leaving a concrete rather then a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.

M. Type "M":
1. Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top member shall overlap the bottom to provide water runoff independent of the seal. Aluminum members shall house electro-galvanized or powder coated springs selected for 0.75”(19mm) minimum deflection. Travel to solid shall be 1.5”(38mm) minimum. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4”(6mm) so as not to interfere with the spring action except in high winds. Manufacturer’s self adhering closed cell sponge gasketing must be used both above and below the base and a flexible EPDM duct like connection shall seal the outside perimeter. Foam or other sliding or shear seals are unacceptable in lieu of the EPDM ductlike closure. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details. Curb mounted bases shall be Type CMAB as manufactured by Mason Industries, Inc.

N. Type "N":

1. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind forces. All directional neoprene snubber bushings shall be a minimum of 1/4”(6mm) thick. Steel springs shall be laterally stable and rest on 1/4”(6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2”(51mm) of insulation. Curb shall be type RSC as manufactured by Mason Industries, Inc.

O. Type "O":
1. Rubber expansion joints shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable. Sizes 1 1/2” through 14”(40mm through 350mm) shall have a ductile iron external ring between the two spheres. Sizes 16” through 24” (400mm to 600mm) may be single sphere. Sizes 3/4” through 2”(19mm through 50mm) may have one sphere, bolted threaded flange assemblies and cable retention.
2. Minimum ratings through 14”(350mm) shall be 250psi at 170°F and 215psi at 250°F. (1.72MPa at 77°C and 1.48MPa at 121°C), 16”(400mm) through 24”(600mm) 180psi at 170°F and 150psi at 250°F. (1.24MPa at 77°C and 1.03 MPa at 121°C). Higher published rated connectors may be used where required.
3. Safety factors shall be a minimum of 3/1. All expansion joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment.
4. The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 1/2”(13mm) thick Neoprene washer bushings large enough to take the thrust at 1000psi (0.7 kg/mm²) of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

P. Type "P":
1. Flexible stainless steel hoses with a safety factor of 4 shall be manufactured using type 304 stainless steel braided hose with one fixed and one floating raised face carbon steel plate flange. Sizes 2 1/2” (65mm) and smaller may have threaded nipples. Copper sweat ends, 4” (100mm) and smaller, may have SS (gas service) or Bronze (water service) bodies. Grooved ends may be used in sizes 2” (50mm) through 12” (300mm). Welding is not acceptable. Minimum lengths, minimum live lengths and minimum number of convolutions per foot to assure flexibility are as tabulated. Shorter lengths are not acceptable.

Pipe or Tubing Size (in) (mm)	Flanged Face to Face (in) (mm)	Flanged Live Length (in) (mm)	Threaded End to End (in) (mm)	Threaded Live Length (in) (mm)	Grooved Ends End to End (in) (mm)	Grooved Ends Live Length (in) (mm)	Copper Sweat Bronze End to End (in) (mm)	Copper Sweat Bronze Live Length (in) (mm)	Minimum Convolutions per (1000) (m)
1/2 15	–	–	24 600	19 3/4 501	–	–	18 457	14 1/4 362	92 302
3/4 20	–	–	24 600	19 3/4 501	–	–	18 457	13 3/4 349	80 262
1 25	–	–	24 600	19 3/4 501	–	–	18 457	13 3/8 340	72 236
1 1/4 30	–	–	24 600	18 3/4 469	–	–	18 457	13 1/4 337	67 220
1 1/2 40	24 600	21 7/8 469	24 600	18 3/4 469	–	–	18 457	13 330	63 207
2 50	24 600	21 1/8 450	24 600	18 450	24 600	18 450	18 457	12 1/2 318	58 190
2 1/2 65	24 600	21 1/8 450	24 600	17 425	24 600	18 450	18 457	10 3/4 273	48 157
3 75	36 900	33 1/8 841	36 900	29 737	36 900	30 750	18 457	10 1/2 267	46 151
4 100	36 900	33 1/8 841	36 900	29 737	36 900	28 700	18 457	15 1/2 394	32 105
5 125	36 900	32 7/8 822	–	–	36 900	28 700	–	–	29 95
6 150	36 900	32 7/8 822	–	–	36 900	28 700	–	–	25 82
8 200	36 900	32 5/8 816	–	–	36 900	28 700	–	–	23 75
10 250	36 900	32 5/8 816	–	–	36 900	26 650	–	–	21 69
12 300	36 900	32 5/8 816	–	–	36 900	26 650	–	–	20 66
14 350	36 900	32 5/8 816	–	–	–	–	–	–	18 59
16 400	36 900	32 5/8 816	–	–	–	–	–	–	16 52

2. Hoses shall be installed on the equipment side of the shut off valves horizontal and parallel to the equipment shafts wherever possible.
3. Submittals shall include original test data showing force/displacement, fittings, material, live lengths, number of corrugations per foot and safety factor at pressure ratings. Hoses shall be type BSS or CPSB as manufactured by Mason Industries, Inc.

Q. Type "Q":
1. Where pipes pass through structural openings, the space shall be sealed by a 2 piece clamp lined with 3/4”(19mm) thick Neoprene Sponge. Concrete or block shall be poured or built around the clamp or back packed with concrete. 10 Lb. density fibreglass with caulked ends will replace the sponge where temperatures exceed 225°F (107°C).
2. Seals shall be type SWS as manufactured by Mason Industries, Inc.

R. Type "R":
1. All-directional acoustical pipe anchors, consist of two sizes of steel tubing separated by a minimum 1/2”(13mm) thickness of 60 duro or softer LDS Rubber. Vertical restraint shall be provided by similar material arranged to prevent up or down vertical travel. Allowable loads on the isolation material shall not exceed 500 psi(3.45 N/mm²) and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.

S. Type "S":
1. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2”(13mm) thickness of 60 durometer or softer neoprene. The height of the guides shall be preset with a set screw to allow vertical motion due to pipe expansion or contraction. Guides shall be capable of ±15/8”(41mm) motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.

T. Type "T":

1. The first four pipe hangers in the main lines near the mechanical equipment shall be as described in specification Type G. Hangers supporting piping 2”(50mm) and larger in all other locations throughout the building shall be isolated by hangers as described in specification F. Floor supported piping shall rest on isolators as described in specification D. Heat exchangers and expansion tanks are considered part of the piping run. The first four isolators from the isolated equipment shall have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first four hangers shall have 0.75”(19mm) deflection for pipe sizes up to and including 3”(75mm), 11/2”(38mm) deflection for pipe sizes over 3”(75mm) and up to and including 6”(150mm), and 2 1/2” (64mm) deflection thereafter. Where piping connects to mechanical equipment install specification O expansion joints or specification P stainless hoses if O is not suitable for the service. All piping passing through the equipment walls, floors or ceilings shall be protected against sound leakage by means of an acoustical seal, as described in Specification Q.

U. Type "U":
1. All vertical risers shall be supported by spring isolators designed to support the riser fille with water, if it is a water line. Assigned loads must be within the building design limits at the support points. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot accommodate this force, anchors can be located on 2 or 3 adjacent floors. Resilient guides shall be spaced and sized properly depending on the pipe diameter. Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. The initial spring deflection shall be a minimum of 0.75”(19mm) or four times the thermal movement at the isolator location, whichever is greater. Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions. Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration vendor for at least 5 years. Proper provision shall be made for seismic protection in seismic zones. The isolator manufacturer shall be the same firm supplying the mechanical contract. Support spring mountings shall be Specification B, anchors Specification R, telescoping guides Specification S.

V. Type "V":
1. All air ducts with a cross section of 2ft²(0.19m²) or larger shall be isolated from the building structure by specification H hangers or B floor supports with a minimum deflection of 0.75”(19mm). Isolators shall continue for 50’(15m) from the equipment. If air velocity exceeds 1000 fpm(5.3mps), hangers or supports shall continue for an additional 50’(15m) or as shown on the drawings.

2.09 SIESMIC ISOLATOR SYSTEM TYPES

A. Type "1":
1. Two layers of 3/4" (19mm) thick neoprene pad consisting of 2" (50mm) square waffle modules separated horizontally by a 16 (1.5mm) gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.

B. Type "2":

1. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" (5mm) and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be Type BR as manufactured by Mason Industries, Inc.

C. Type "3":
   1. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.

D. Type "4":
   1. A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.

E. Type "5":
   1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be Type SLF as manufactured by Mason Industries, Inc.

F. Type "6":
   1. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Preapproval "R" Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall beType SLR as manufactured by Mason Industries, Inc.

G. Type "7":

1. Spring mountings as in specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4" (6mm) travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Preapproval "R" number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be Type SSLFH as manufactured by Mason Industries, Inc.

H. Type "8":
1. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8" (3mm). Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.

I. Type "9":
1. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be Type SLR-MT as manufactured by Mason Industries, Inc.

J. Type "10":
1. Hangers shall consist of rigid steel frames containing minimum 1 1/4" (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30 degree capability. Hangers shall be Type 30N as manufactured by Mason Industries, Inc.

K. Type "11":
1. Hangers shall be as described in 10, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30 degree capability. Hangers shall be Type PC30N as manufactured by Mason Industries, Inc.

L. Type "12":

1. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be prestretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, Type SCBH between the hanger rod nut and the clevis or Type SCBV if clamped to a beam all as manufactured by Mason Industries, Inc.

M. Type "13":
1. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be Type SSB as manufactured by Mason Industries, Inc.

N. Type "14":
1. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be Type SRC as manufactured by Mason Industries, Inc.

O. Type "15":
1. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Clevis cross brace shall be Type CCB as manufactured by Mason Industries, Inc.

P. Type "16":
1. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4" (6mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm2). A minimum air gap of 1/8" (3mm) shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Snubber shall be Type Z-1225 as manufactured by Mason Industries, Inc.

Q. Type "17":

1. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" (19mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm2). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" (3mm) nor more that 1/4" (6mm). Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" (9mm) deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to 1/2" (12mm) deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be series Z-1011 as manufactured by Mason Industries, Inc.

R. Type "18":
   1. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is "rolled up" to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be Type SAS as manufactured by Mason Industries, Inc.

S. Type "19":
   1. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be Type SAB as manufactured by Mason Industries, Inc.

T. Type "20":
   1. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" (350mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1" (25mm). Bases shall be Type WF as manufactured by Mason Industries, Inc.

U. Type "21":
   1. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6" (150mm). The base depth need not exceed 12" (300mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" (12mm) bars welded in place on 6" (150mm) centers running both ways in a layer 1 1/2" (38mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" (25mm) clearance below the base. Wooden formed bases leaving a concrete rather then a steel finish are not acceptable. Base shall be Type BMK or K as manufactured by Mason Industries, Inc.

V. Type "22":
   1. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4" (6mm) thick. Steel springs shall be laterally stable and rest on 1/4" (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2" (50mm) of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower Z section anchored to the roof structure. Curb shall have anchorage preapproval "R" from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings. Curb shall be Type RSC as manufactured by Mason Industries, Inc.

W. Type "23":
   1. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar7 tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" (50mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16" (400mm) to 24" (600mm) may be single sphere. Sizes 3/4" (19mm) to 1 2" (38mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi (1.72MPa) up to 170 degree F (77 degree C) with a uniform drop in allowable pressure to 215 psi (1.48MPa)at 250 degree F (121 degree C) and 150 psi (1.03 MPa) at 250 degree F (121 degree C).
   2. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have 2" (12mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (.7 kg/mm2) maximum on the washer area.
   3. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

X. Type "24":
   1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

FLANGED			MALE NIPPLES	
3x14	10x26		1/2x9	2x14
4x15	12x28		3/4x10	2-1/2x18

5x19	14x30		1x11	
6x20	16x32		1-1/4x12	
8x22			1-1/2x13	

2. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be Type BSS as manufactured by Mason Industries, Inc.

Y. Type "25":
1. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" (12mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (.35 kg/mm2) and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be Type ADA as manufactured by Mason Industries, Inc.

Z. Type "26":
1. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (12mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of +/- 1 5/8" (41mm) motion, or to meet location requirements. Pipe guides shall be Type VSG as manufactured by Mason Industries, Inc.

AA. Type "27":
1. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" (19mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of l" (25mm) past either face of the wall. Where temperatures exceed 240 degree F(115 degree C), 10# (4.5kg) density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.

BB. Type "28":
1. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" (6mm) movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the duct work or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be Type WBI/WBD as manufactured by Mason Industries, Inc.

CC. Type "29":
1. Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass thru. The anchor shall be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping pad anchors shall be attached to the structural slab using a stud wedge anchor. Housekeeping pad anchors shall be type HPA and stud wedge anchor shall be type SAS both as manufactured by Mason Industries, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
   1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 VIBRATION ISOLATION GENERAL

A. All vibration isolators must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. 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 contractors expense.

G. 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 contractors expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.

I. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24” (600mm) or specified movements exceed Type "O" vibration isolators capabilities.

J. Locate isolation hangers as near to the overhead support structure as possible.

K. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust when thrust forces exceed 10% of the equipment weight. Horizontal thrust restraints shall be Type "I" restraints.

L. Rooftop equipment isolators must be bolted to the equipment and structure. Mountings must be designed to resist 100m/h (160 km/h) wind loads.

3.04 VIBRATION ISOLATION OF PIPING

A. Horizontal pipe shall be installed in accordance with Type "T" Horizontal Pipe Isolation.

B. Risers shall be installed in accordance with Type "U" Riser Isolation.

3.05 VIBRATION ISOLATION OF DUCTWORK

A. All duct runs shall be installed in accordance with Type "V" Duct Isolation.

3.06 SEISMIC GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. 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 contractors expense.

G. 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 contractors expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.

I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
   1. Flanges of structural beams.
   2. Upper truss cords in bar joist construction.
   3. Cast in place inserts or wedge type drill-in concrete anchors.

J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

K. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.

L. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.

M. At all locations where specification 12 or 13 restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with specification type 15 braces.

N. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.

O. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.

P. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.

Q. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.

R. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28 (see selection guide).

S. Locate isolation hangers as near to the overhead support structure as possible.

3.07 VIBRATION ISOLATON OF SIESMIC PIPING

A. Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10. Floor supported piping shall rest on isolators as described in specification 6. Heat exchanger's and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm), 1 1/2" (38mm) deflection for pipe sizes up to and including 6" (150mm), and 2 1/2" (64mm) deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Riser isolation: Risers shall be suspended from specification 10 hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification 26 sliding guides. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to + 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

C. Seismic Restraint of Piping:
   1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.

a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1" (25mm) I.D. or larger.
b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" (32mm) I.D. and larger.
c. All other piping 2 1/2" (64mm) diameter and larger.

2. Transverse piping restraints shall be at 40' (12m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
3. Longitudinal restraints shall be at 80' (24m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
5. For fuel oil and all gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600m) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
8. Branch lines may not be used to restrain main lines.
9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in Zones 2B, 3 and 4 shall be braced as in sections 3.02.C.2 and 3. For Zones 0, 1 and 2A, 2 band clamps may be used with reduced spacings of 1/2 of those listed in sections 3.02.C.2 and 3.

D.

1. All discharge runs for a distance of 50' (15m) from the connected equipment shall be isolated from the building structure by means of specification 10 hangers or specification 5 floor isolators. Spring deflection shall be a minimum of 0.75" (19mm).
2. All duct runs having air velocity of 1000 fpm (5 m/s)or more shall be isolated from the building structure by specification 11 hangers or 5 floor supports. Spring deflection shall be a minimum of 0.75" (19mm).

E. Seismic restraint of duct work:

1. Seismically restrain all duct work with specification 12 or 13 restraints as listed below:
   a. Restrain rectangular ducts with cross sectional area of 6 sq.ft. (.5 m2) or larger.
   b. Restrain round ducts with diameters of 28" (700mm) or larger.
   c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
2. Transverse restraints shall occur at 30' (9mm) intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
3. Longitudinal restraints shall occur at 60' (18m) intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
4. The ductwork 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.

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.

F. Seismic Restraint of Electrical Services:
1. All electrical conduit 2 1/2" (64mm) in diameter and larger shall be restrained with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.
2. All electrical bus ducts, cable trays and ladder trays shall be restrained with specification type 12, seismic cable restraints or specification 13 seismic solid brace restraints.
3. Transverse restraints shall occur at 30' (9m) intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
4. Longitudinal restraints shall occur at 60' (9m) intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the electric run and if the restraints are sized for the larger electric run.
5. All rigid floor mounted equipment must have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with section seismic forces. Neoprene bushings shall be specification type 4 and anchor bolts shall be specification type 18 or 19.
6. Wall mounted panels shall be mounted with specification type 3 bushings. Floor mounted panels shall be mounted on specification type 4 bushings. Anchor bolts shall be specification type 18 or 19.

G. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

H. All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in part 4 of this specification.

I. All fire protection equipment is considered life safety equipment and shall be seismically restrained using the seismic force levels for life safety equipment in table 1.06-1. if higher levels are shown.

3.08 SEISMIC RESTRAINT EXCLUSIONS

A. Piping:
1. Gas piping less than 1" (25mm) inside diameter.
2. Piping in boiler and mechanical rooms less than 1 1/4" (32mm) inside diameter.
3. All other piping less than 2 1/2" (64mm) inside diameter.
4. All piping suspended by individual hangers 12" (300mm) or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run. The 12" (300mm) exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.

B. Ductwork:
1. Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
2. Oval ducts that are less than 6 square feet (.5m2) in cross sectional area based on nominal size.

3. Round duct less than 28" (.5m2) in diameter.
4. All duct suspended by hangers 12" (300mm) or less in length as measured from the top of the duct to the point of attachment to the structure. Hangers must be attached within 2" (50mm) of the top of the duct with a minimum of two #10 sheet metal screws. If the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run.

C. Electrical:
1. All conduit less than 2 1/2" (64mm) diameter suspended by individual hanger rods.
2. All conduits suspended by individual hangers 12" (300mm) or less as measured from the top of the conduit to the bottom of the support where the hanger is a attached. However, if the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run. The 12" (300mm) exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.

D. Suspended equipment:
1. VAV boxes and fan powered equipment weighing less than 50 lbs. (23kg) and rigidly connected to the supply side of the duct system and supported with a minimum of 4 hanger rods.

3.09 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Field-Welding (where approved by Architect): Comply with Section 05 50 00.

E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:
1. Vibration-Isolated Equipment Support Bases:
a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
a. Position equipment at operating height; provide temporary blocking as required.
b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Thrust Restraints:
a. Adjust restraint movement under normal operating static pressure.
5. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
6. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
7. Adjust isolators to be free of isolation short circuits during normal operation.

8. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

G. Seismic Controls:
   1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
   2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
   3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch (3 mm), use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch (3 mm) or less.
   4. Equipment with Sheet Metal Housings:
      a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
      b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
      c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
   5. Concrete Housekeeping Pads:
      a. Size in accordance with seismic design to meet anchor requirements.
      b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
   6. Seismic Restraint Systems:
      a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
      b. Install restraints within permissible angles in accordance with seismic design.
      c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
      d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
      e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.10 FIELD QUALITY CONTROL

A. Inspect vibration isolation and/or seismic control components for damage and defects.

B. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.

C. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:
   1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.11 ATTACHMENTS

A. Statement of special inspections.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

E. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.03 SUBMITTALS

A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags and ceiling tacks where located above lay-in ceiling

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Ductwork: Adhesive-backed duct markers.

G. Heat Transfer Equipment: Nameplates.

H. Instrumentation: Tags.

I. Major Control Components: Nameplates.

J. Piping: Pipe markers.

K. Pumps: Nameplates.

L. Relays: Tags.

M. Small-sized Equipment: Tags.

N. Tanks: Nameplates.

O. Thermostats: Tags.

P. Valves: Tags and ceiling tacks where located above lay-in ceiling.

Q. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Material and Thickness: Aluminum, 0.032-inch, or anodized aluminum of same thickness.

B. Label Size: Not less than 2-1/2 inch x 3/4 inch.

C. Letter Color: Black.

D. Letter Height: 1/4 inch (6 mm).

E. Background Color: Aluminum.

F. Fasteners: Stainless-steel rivets and self-tapping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and substrate.

2.03 TAGS

A. Material and Thickness: Laminated three-layer plastic with engraved letters on light contrasting background color. Comply with ASTM D709.

B. Label Size: Not less than 2-1/2 inch x 3/4 inch.

C. Letter Color: Black.

D. Letter Height: 1/4 inch (6 mm).

E. Background Color: White.

F. Fasteners: Stainless-steel rivets and self-tapping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and substrate.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Refer to schedule at end of section..

D. Size: 2-1/4 inch x 16 inch.

E. Comply with ANSI/ASME A13.1.

2.05 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil, 0.004 inch (0.10 mm) thick, manufactured for direct burial service.

E. Color code: Refer to schedule at end of section.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.

2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic tape pipe markers in accordance with manufacturer's instructions.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

E. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at bothes sides of floor or wall penetrations.
   4. Place pipe marker every 25 feet interval of straight run on congested areas.
   5. Place pipe marker every 50 feet interval on straight run on open areas.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.03 SCHEDULE

A. Pipe-Label Color Schedule:

SYSTEM TYPE	BACKGROUND COLOR	LETTER COLOR	FLOW ARROW
Chilled-Water Supply	ANSI Z535.1 Safety-Green	White	Yes
Chilled-Water Return	ANSI Z535.1 Safety-Green	White	Yes
Glycol Chilled-Water Supply	ANSI Z535.1 Safety-Green	White	Yes
Glycol Chilled-Water Return	ANSI Z535.1 Safety-Green	White	Yes
Condenser-Water Supply	ANSI Z535.1 Safety-Green	White	Yes

Condenser-Water Return	ANSI Z535.1 Safety-Green	White	Yes
Geothermal-Water Supply	ANSI Z535.1 Safety-Green	White	Yes
Geothermal-Water Return	ANSI Z535.1 Safety-Green	White	Yes
Heating Water Supply	ANSI Z535.1 Safety-Green	White	Yes
Heating Water Return	ANSI Z535.1 Safety-Green	White	Yes
Glycol Heating Water Supply	ANSI Z535.1 Safety-Green	White	Yes
Glycol Heating Water Return	ANSI Z535.1 Safety-Green	White	Yes
Refrigerant-Liquid	ANSI Z535.1 Safety-Blue	White	No
Refrigerant-Suction	ANSI Z535.1 Safety-Blue	White	No
Low-Pressure Steam	ANSI Z535.1 Safety-Yellow	Black	Yes
Medium-Pressure Steam	ANSI Z535.1 Safety-Yellow	Black	Yes
High-Pressure Steam	ANSI Z535.1 Safety-Yellow	Black	Yes
Low-Pressure Steam Condensate	ANSI Z535.1 Safety-Yellow	Black	Yes
Medium-Pressure Steam Condensate	ANSI Z535.1 Safety-Yellow	Black	Yes
High-Pressure Steam Condensate	ANSI Z535.1 Safety-Yellow	Black	Yes
Low Pressure Natural Gas	ANSI Z535.1 Safety-Yellow	Black	Yes
2 PSI Pressure Natural Gas	ANSI Z535.1 Safety-Yellow	Black	Yes
5 PSI Pressure Natural Gas	ANSI Z535.1 Safety-Yellow	Black	Yes
10 PSI Pressure Natural Gas	ANSI Z535.1 Safety-Yellow	Black	Yes
Fuel Oil Supply	ANSI Z535.1 Safety-Yellow	Black	Yes
Fuel Oil Return	ANSI Z535.1 Safety-Yellow	Black	Yes
Propane	ANSI Z535.1 Safety-Yellow	Black	Yes
Toxic or Corrosive Fluids	ANSI Z535.1 Safety-Orange	Black	Yes
Flammable Fluids	ANSI Z535.1 Safety-Yellow	Black	Yes
Combustible Fluids	ANSI Z535.1 Safety-Brown	White	Yes
Potable Water	ANSI Z535.1 Safety-Green	White	Yes
Compressed Air	ANSI Z535.1 Safety-Blue	White	Yes

B. Duct Label Color Schedule:

SYSTEM TYPE	BACKGROUND COLOR	LETTER COLOR	FLOW ARROW
Supply Air	Blue	White	Yes
Return Air	Blue	White	Yes
Exhaust Air	Blue	White	Yes
Outside Air	Blue	White	Yes
Mixed Air	Blue	White	Yes
Relief	Blue	White	Yes
Flue Gas	Orange	Black	Yes
Combustion Air	Blue	White	Yes

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 CONDITIONS OF THE CONTRACT

A. The General and Supplementary General Conditions as previously detailed along with the general requirements listed in Division 1 shall apply to all work of this Division.

B. All work shall conform to the local Municipal Specifications where conflicts exist. Applicable CSA standards will prevail where ANSI or ASTM conflict with CSA standards.

C. HVAC Contractor is responsible to furnish, install and execute all of the following work as required, specified and/or indicated on plan unless noted to be performed by another contractor.

1.02 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. Domestic hot water circulating systems.

1.03 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.

1.04 SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.05 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.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

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 Construction Manager.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 TAB

A. TAB will be responsible to carry out the commissioning requirements specified in Section 23 09 99 and other sections referenced in Section 23 09 99, and specified in 26 09 95 and other sections referenced in 26 09 95.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 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 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 Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

E. 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.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. 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.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. 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.

3.02 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.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

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 Division 23 Section "HVAC 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) units.

3.04 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 and submit digital copies of 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 Division 23 Section "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Contractor shall obtain and review training materials produced by Lennox before balancing Lennox Roof Top Unit. This information can be provided by owner or Lennox.

B. 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 Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   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.

C. 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.

D. 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.

E. 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.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Contractor shall obtain and review training materials produced by Lennox before balancing Lennox Roof Top Units. This information can be provided by owner or Lennox.

B. 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.

C. 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.
      a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
   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.

3.07 PROCEDURES FOR BUILDING PRESSURIZATION

A. After the entire building has been balanced the overall building pressurization should be measured. The building overall pressurization should be at a positive pressure of +0.03” wc.
   1. Building Pressure over 0.05” wc:
      a. Verify that the outdoor air dampers are operating properly and in the correct position.

1) Document outdoor air damper control signal form unitary controller and provide to controls contactor.

b. Verify exhaust fans are operating properly and balanced.
c. Verify the building doors are shut and operating in a normal mode.
d. Adjust energy recovery units to get the building pressurization within tolerance.

2. Building Pressure under 0.02” wc:
   a. Verify that the outdoor air dampers are operating properly and in the correct position
   b. Verify exhaust fans are operating properly and balanced
   c. Adjust energy recovery units to get the building pressurization within tolerance.

B. Once the building overall pressurization is when tolerance the BAS System should be calibrated to match the actual readings measured by the TAB contractor. This work should be conducted as a coordinated team effort with both contractors onsite.

C. Rooftop Unit Powered Exhaust:
   1. TAB shall measure return air static pressure and associated CFM of each installed rooftop unit. These measured values shall be compared against the manufacturers published power exhaust fan performance data.
   2. The Rooftop Unit Powered Exhaust shall be commanded to run when the Outside Air Damper position results in an outside airflow value 10% (adj) greater than the listed power exhaust fan performance to maintain positive buidling pressurization as defined above.

3.08 PRESSURE TESTING OF DUCTWORK

A. The balancing subcontractor shall be responsible for pressure test verification of the entire ventilation system for leakage. Supply all necessary equipment to pressure test duct work. Pressure testing shall take place during construction as required, in accordance with section 23 31 13.

B. Testing supply, return and exhaust duct work shall be done as follows: After the duct work is fabricated and installed, it shall be isolated in sections and tested for air tightness. The air pressure used for the test shall match that specified under section 23 31 13. The ductwork shall be tested to a pressure class A described per SMACNA. The ductwork shall be tested so that the sealing of the ductwork shall be a leakage class 6. This means that 6 CFM of leakage per 100 sq ft of duct surface is the maximum allowable threshold if tested at 1 inch test pressure. See additional duct sealing requirements in the latest edition SMACNA manual "HVAC Air Duct Leakage Test Manual." Do this prior to applying an thermal insulation. In testing for air tightness, the main trunk shall be first tested by blanking off all branch take-offs, then each branch shall be tested individually after main trunk is proven air tight. No equipment connections shall be made on ends of branches until after testing. Ends and other branches shall be blanked off with air tight seals taped in place or other approved methods. Soap solution brushed on shall be used where necessary to detect small leaks.

C. The balancing contractor performing the leakage testing shall utilize a small scale drawing to show which ductwork corresponds to the duct testing data. This drawings shall individually number each section of ductwork being tested and be included in the final duct pressure testing and balancing report.

D. Duct pressure testing report shall include the following information:
   1. The date of the test.
   2. The project name.
   3. A description of the duct being tested (identification of the duct from small scale plan as called out above), sealing classification and duct classification.
   4. The design and actual test static pressure.
   5. The design and actual leakage rating.

6. Calculation of the duct leakage rating.
7. If the duct passed or failed.
8. Description of the apparatus utilized during testing including orifice size, manufacturer and date calibrated.
9. The actual orifice pressure drop with the actual flow.
10. The name of the person performing the test and any witnesses.

3.09 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 and submit digital copies of 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.

3.10 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 Architect and comply with requirements in Division 23 Section "Hydronic Pumps."
   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.

3.11 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.

3.12 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.

3.13 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.14 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 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.

3.15 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.

3.16 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 biweekly progress reports 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.

3.17 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.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Weather barrier coatings.

D. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.

B. Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

I. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

J. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

K. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

L. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

N. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

O. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

P. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

Q. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

R. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

S. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
   4. Knauf Insulation; Performance+ Duct Wrap: www.knaufinsulation.com/#sle.
   5. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F (649 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

G. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F (232 degrees C).
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 pcf (128 kg/cu m).

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA; AEROFLEX Breathe-EZ: www.aeroflexusa.com/#sle.
2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Maximum Service Temperature: 180 degrees F (82 degrees C).

3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.05 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm (57 ng/(Pa s m)) in accordance with ASTM E96/E96M.
   3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   4. Color: As selected by Architect.

2.06 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

C. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch (0.40 mm) sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   5. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

D. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
   2. Finish: Aluminum smooth.
   3. Comply with ASTM C1775.

E. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

F. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.
   1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
   2. Thickness: 34 mil, 0.034 inch (0.86 mm).
   3. Finish: Embossed.
   4. Color: Silver.
   5. Water Vapor Transmission: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
   6. Mold Resistance: Pass when tested in accordance with ASTM C1338.

7. Emissivity: 0.30 when tested in accordance with ASTM C1371.

G. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

H. Plain Foil Tape:
1. Aluminum foil with pressure-sensitive adhesive on paper release liner.
2. Finish: Plain foil.

I. UL181 Tape for Rigid and Flexible Ductwork:
1. Comply with UL 181A for rigid ductwork.
2. Comply with UL 181B for flexible ductwork.
3. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
4. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
5. Finish: Printed with UL Listing for identification.

2.07 DUCT LINER

A. Manufacturers:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Johns Manville: www.jm.com/#sle.
4. Owens Corning Corporation; QuietR Rotary Duct Insulation: www.ocbuildingspec.com/#sle.

B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).
3. Service Temperature: Up to 250 degrees F (121 degrees C).
4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.
5. Minimum Noise Reduction Coefficients:
a. 1/2 inch (13 mm) Thickness: 0.30.
b. 1 inch (25 mm) Thickness: 0.45.
c. 1-1/2 inches (40 mm) Thickness: 0.60.
d. 2 inch (50 mm) Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. **PVC or ABS jacketing shall not be installed in return air plenums.**

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NAIMA National Insulation Standards.

D. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

E. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

F. Slope exterior ductwork to shed water.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.03 ITEMS NOT INSULATED.

A. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.

B. Factory-insulated flexible ducts.

C. Factory-insulated plenums and casings.

D. Flexible connectors.

E. Vibration-control devices.

F. Factory-insulated access panels and doors.

G. Exposed indoor supply air ducts in conditioned space in area being served.

H. Exposed indoor return air duct in conditioned space in area being served.

3.04 PLENUMS AND DUCTS REQUIRING INSULATION:

A. Indoor, concealed supply and outdoor air.

B. Indoor, exposed supply and outdoor air.

C. Indoor, concealed return located in non-conditioned space.

D. Indoor, exposed return located in non-conditioned space.

3.05 DUCT INSULATION SCHEDULE

A. Supply-Air Duct Mains: R-6 Fibrous insulation liner on all supply duct mains. R-6 duct wrap with foil vapor barrier is an acceptable alternative to liner in non-exposed areas, although the first 15’ from the supply unit must be installed with duct liner.

B. Supply Air Branches (Round run out to each diffuser): R-6 wrap insulation with foil vapor barrier.

C. Supply ductwork located Outdoors: Double wall duct with R-12 Mineral-fiber blanket insulation between duct walls and solid NON-perforated inner duct.Exterior duct wall shall be aluminum with joints sealed water tight.

D. Outdoor-Air Duct Mains: R-8 Fibrous insulation liner on all. R-8 duct wrap with foil vapor barrier is an acceptable alternative to liner in non-exposed areas.

E. Return-Air Duct Mains: R-6 Fibrous insulation liner on the first 15’ of ductwork off the supply unit. All return air ducts located in shafts on outside walls must be wrapped with R-6 insulation within the shaft enclosure.

F. Exhaust ductwork: No duct liner allowed. R-6 insulation wrap with foil vapor barrier on the final 10’ thru roof or at connection to unit at roof, unless noted otherwise on plan.

G. Exhaust duct from locker room (EF-1,8,10,11) – No duct liner allowed. First 10’ from unit connection shall be wrapped with R-6 insulation.

H. Yoga Supply and Return Ducts (RTU-1): Two layers of R-4.2 wrap insulation with foil vapor barrier equaling R-8.4. Single layer of R-8 is not acceptable.

I. Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve UL 1-1/2-hour fire rating for grease duct. 3M Fire barrier 615+ to meet NFPA 96, ASTM E-2336 or equal.

J. Category IV appliance venting, polypropylene and CPVC ducting located in plenums: Fire-rated blanket; thickness as required to achieve UL 1-1/2 fire rating. 3M Fire Barrier Plenum Wrap 5A+.

END OF SECTION

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SECTION 23 07 16
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

B. Flexible removable and reusable blanket insulation.

C. Weather barrier coatings.

D. Jacketing and accessories.

E. Breeching insulation.

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment.

B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

C. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

G. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

H. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

I. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

J. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

K. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

L. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

N. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

O. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible.
   1. K (Ksi) Value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 1,000 degrees F (538 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   1. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   2. Secure with self-sealing longitudinal laps and butt strips.

D. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A. Description: Custom cut and fabricated, removable and reusable blanket insulation system, consisting of inner liner, insulation layer, outer protective jacket, and fastening system.

B. Provide insulation system based on surface temperature of piping, installed location of piping, and maximum safe-to-touch temperature of jacketing.

C. Performance Criteria:
   1. Safe-to-Touch Temperature of Jacketing: 140 degrees F (60 degrees C).

2.04 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
   1. K (Ksi) Value: 0.25 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F (649 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.
   4. Maximum Density: 8.0 pcf (128 kg/cu m).

C. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

D. Vapor Barrier Jacket:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   3. Secure with self-sealing longitudinal laps and butt strips.

E. Facing: 1 inch (25 mm) galvanized steel hexagonal wire mesh stitched on one face of insulation.

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.05 CELLULAR GLASS

A. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
   1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).
   2. Service Temperature Range: From 250 degrees F (121 degrees C) to 800 degrees F (427 degrees C).
   3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.
   5. Density: At least 6.12 pcf (98 kg/cu m), minimum.

B. Block Insulation: ASTM C552, Type I, Grade 6.
   1. K (Ksi) Value: 0.35 at 100 degrees F (0.050 at 38 degrees C).
   2. Service Temperature: 800 degrees F (427 degrees C), maximum.
   3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
   4. Water Absorption: 0.5 percent by volume, maximum.
   5. Density: 6.12 pcf (98 kg/cu m), minimum.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA; AEROFLEX EPDM Sheet/Roll: www.aeroflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.07 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm (57 ng/(Pa s m)) in accordance with ASTM E96/E96M.
   3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   4. Color: As selected by Architect.

2.08 JACKETING AND ACCESSORIES

A. PVC Plastic:
   1. Jacket: Sheet material, off-white color.
      a. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch (0.25 mm).
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch (0.40 mm) sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   5. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

C. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
   2. Finish: Aluminum smooth.
   3. Comply with ASTM C1775.

D. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

E. Reinforced Tape:

1. FSK tape suitable for sealing seams in insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

F. Plain Foil Tape:
1. Aluminum foil with pressure-sensitive adhesive on paper release liner.
2. Finish: Plain foil.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

H. For hot equipment containing fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

I. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.

J. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Inserts and Shields:
1. Application: Equipment 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between hangers and inserts.
3. Insert Location: Between support shield and equipment and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Finish insulation at supports, protrusions, and interruptions.

M. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

N. Exterior Applications:
   1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
   2. Cover with aluminum.

O. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

A. HVAC EQUIPMENT INSULATION SCHEDULE
   1. HVAC EQUIPMENT INSULATION SCHEDULE

HVAC EQUIPMENT	Insulation Types (1)	Density (lbs./cu ft.)	Insulation Thickness	Vapor Barrier Requirements (2)	Jacket Types (3)
AIR SEPERATOR, EXPANSION TANK, BUFFER TANK (100°F-140°F)	GF	3.5	1-1/2 INCH	YES	AP
AIR SEPERATOR, EXPANSION TANK, BUFFER TANK (ABOVE 140°F)	GF	3.5	2 INCH	YES	AP
HEATING WATER PUMPS	GF	3.5	2 INCH	YES	GC
HEAT EXCHANGER	GF	3.5	2 INCH	YES	GC
BOILER FEED WATERTANK, CONDENSATE TANK, DEAERATOR TANK (200°F-250°F OR 15 PSIG AND LESS)	GF	3.5	3 INCH	YES	GC
BOILER FEED WATERTANK, CONDENSATE TANK, DEAERATOR TANK (250°F-350°F OR 16 PSIG -125 PSIG)	GF	3.5	4-1/2 INCH	YES	GC
BOILER FEED WATERTANK, CONDENSATE TANK, DEAERATOR TANK (ABOVE 350°F OR ABOVE 125 PSIG)	GF	3.5	5 INCH	YES	GC
AIR SEPERATOR, EXPANSION TANK, BUFFER TANK (40°F-60°F)	GF	3.5	1-1/2 INCH	YES	AP

HVAC EQUIPMENT	Insulation Types (1)	Density (lbs./cu ft.)	Insulation Thickness	Vapor Barrier Requirements (2)	Jacket Types (3)
CHILLED WATER PUMPS	GF	3.5	1 INCH	YES	GC
CHILLER	GF	3.5	2 INCH	YES	GC

(1) Key to Insulation Materials:
GF = Glass or Mineral Fiber
CG = Cellular Glass
FE = Flexible Elastomeric Foam
PF = Closed Cell Phenolic Foam
CS = Calcium Silicate
HTGF = High Temperature Glass Fiber

(2) Key to Vapor Barrier Requirements:
Yes = Required
None = Not Required
SJ = Continuous sealed joints required

(3) Key to Jacket Requirements:
AP = All purpose foil, scrim, kraft paper jacket (white)
FSK = Foil, scrim, kraft paper jacket with foil finish
PVC = PVC Jacket
AL = Aluminum Jacket
SS = Stainless Steel Jacket
GC = Canvas or glass cloth

END OF SECTION

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SECTION 23 82 39
ELECTRIC HEATERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cabinet unit heaters with centrifugal fans
   2. Electric-resistance heating coils.
   3. Radiant ceiling panel heaters.

1.02 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Plans, elevations, sections, and details.
   2. Location and size of each field connection.
   3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 PRODUCTS

2.01 CABINET UNIT HEATERS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Subject to compliance with requirements, provide the product indicated on Drawings. Berko Electric Heating; FRC Series or a comparable product by one of the following:
   1. Berko Electric Heating; a division of Marley Engineered Products.
   2. Markel Products; a division of TPI Corporation.
   3. Marley Electric Heating; a division of Marley Engineered Products.
   4. QMark Electric Heating; a division of Marley Engineered Products.

D. Description: A factory-assembled and -tested unit complying with ARI 440.
   1. Comply with UL 2021.

E. Coil Section Insulation: Glass-fiber insulation; surfaces exposed to airstream shall be aluminum-foil facing to prevent erosion of glass fibers.
   1. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
   2. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
   3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

F. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect..

G. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

H. 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 23 05 13 "Common Motor Requirements for HVAC."
   3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

I. Basic Unit Controls:
   1. Control voltage transformer.
   2. Unit-mounted thermostat with the following features.
      a. Heat-off switch.
      b. Fan on-auto switch.
      c. Manual fan speed switch.
   3. Unit-mounted temperature sensor.
   4. Summer Fan Switch

J. Electrical Connection: Factory wire motors and controls for a single field connection.

2.02 TOE-SPACE UNIT HEATERS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Subject to compliance with requirements, provide the product indicated on Drawings. Berko Electric Heating; FRC Series or a comparable product by one of the following:
   1. Broan-NuTone, LLC.
   2. Berko Electric Heating; a division of Marley Engineered Products.
   3. Markel Products; a division of TPI Corporation.
   4. Marley Electric Heating; a division of Marley Engineered Products.
   5. QMark Electric Heating; a division of Marley Engineered Products.

D. Description: A factory-assembled and -tested unit complying with ARI 440.
   1. Comply with UL 2021.

E. Coil Section Insulation: Glass-fiber insulation; surfaces exposed to airstream shall be aluminum-foil facing to prevent erosion of glass fibers.

1. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
2. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

F. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect..

G. Electric-Resistance Heating Coil: The heating element shall be of non-glowing design consisting of 80% nickel, 20% chromium resistance wire enclosed in a steel sheath to which steel plate fins are brazed. The element shall cover the entire air discharge area to ensure uniform heating of all discharge air. The wattage output of the unit shall be adjustable by removing a jumper wire.

H. 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 23 05 13 "Common Motor Requirements for HVAC."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

I. The fan motor shall be impedance protected and permanently lubricated. An optional single pole thermostat accessory shall be specified when the unit will not utilize a single pole wall thermostat. Note: Three conductor wire is required when a two pole thermostat is used. The over temperature protector shall be bi-metallic, snap-action type designed to shut off heater in the event of overheating. A pilot light shall be provided that will illuminate if the over temperature protector operates.

J. A thermal fuse shall provide secondary thermal cut-out for added safety.

K. Basic Unit Controls:
1. Control voltage transformer.
2. Unit-mounted thermostat with the following features.
   a. Heat-off switch.
   b. Fan on-auto switch.
   c. Manual fan speed switch.
3. Unit-mounted temperature sensor.

L. Electrical Connection: Factory wire motors and controls for a single field connection.

2.03 COILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck
2. Chromalox, Inc.
3. INDEECO.

B. Testing Agency Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Coil Assembly: Comply with UL 1995.

D. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.

E. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.
   1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.

F. Frames: Galvanized-steel channel frame, minimum 0.052-inch-thick for slip-in mounting.

G. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
   1. Magnetic contactor.
   2. Mercury contactor.
   3. Toggle switches; one per step.
   4. Step controller.
   5. Time-delay relay.
   6. Pilot lights; one per step.
   7. Airflow proving switch.

H. See DI series sheets for thermostat.

2.04 RADIANT CEILING PANEL HEATERS

A. 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. QMARK

C. Description: A factory-assembled and -tested unit complying with ARI 440.
   1. Comply with UL 2021.

D. Coil Section Insulation: 25-mm (1” thick), 1 lb. high-temperature glass-fiber insulation separated from the inside panel by a dielectric insulation.
   1. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
   2. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.

E. Panel:
   1. Metal heating panel of 22 gauge galvanized steel front 24 gauge galvanized steel back. Sides overlap front and back panels riveted together.
   2. Mounting kit furnished with unit, field installed. Reference schedule for surface or recess mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Retain paragraph below if controls are provided by unit heater manufacturer. To comply with requirements of the Americans with Disabilities Act, verify mounting height with authorities having jurisdiction.

C. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

D. Install piping adjacent to machine to allow service and maintenance.

E. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

F. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Section 23 33 00 "Duct Accessories."

G. Comply with safety requirements in UL 1995.

H. Ground equipment according to Division 26 Section "Grounding and Bonding."

I. Connect wiring according to Division 26 Section "Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   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. Remove and replace malfunctioning units and retest as specified above

END OF SECTION

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SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Weather barrier coatings.

D. Jacketing and accessories.

E. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

B. Section 23 22 13 - Steam and Condensate Heating Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

F. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

I. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

J. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

K. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

L. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

M. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

N. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

O. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

P. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).

Q. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

S. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

T. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

U. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

V. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

W. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

X. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) Value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F (649 degrees C).

3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film with pressure-sensitive rubber-based adhesive.

E. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
2. Maximum Service Temperature: 850 degrees F (454 degrees C).
3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
2. Maximum Service Temperature: 220 degrees F (104 degrees C).
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
2. Maximum Service Temperature: 650 degrees F (343 degrees C).
3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/(Pa s m)).

E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Blanket: 1.0 pcf (16 kg/cu m) density.
3. Weave: 5 by 5.

I. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

J. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement: ASTM C449.

2.04 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A. Description: Custom cut and fabricated, removable and reusable blanket insulation system, consisting of inner liner, insulation layer, outer protective jacket, and fastening system.

B. Provide insulation system based on surface temperature of piping, installed location of piping, and maximum safe-to-touch temperature of jacketing.

C. Performance Criteria:
1. Safe-to-Touch Temperature of Jacketing: 140 degrees F (60 degrees C).

2.05 CELLULAR GLASS

A. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).
2. Service Temperature Range: From 250 degrees F (121 degrees C) to 800 degrees F (427 degrees C).
3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: A minimum of 6.12 pcf (98 kg/cu m).

B. Block Insulation: ASTM C552, Type I, Grade 6.
1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).
2. Service Temperature: 800 degrees F (427 degrees C), maximum.
3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Maximum Service Temperature: 180 degrees F (82 degrees C).
3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

C. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.07 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
2. Water Vapor Permeance: Greater than 1.0 perm (57 ng/(Pa s m)) in accordance with ASTM E96/E96M.
3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
4. Color: As selected by Architect.

2.08 JACKETING AND ACCESSORIES

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).
   b. Maximum Service Temperature: 150 degrees F (66 degrees C).
   c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 10 mil, 0.010 inch (0.25 mm).
   e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch (0.40 mm) sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Finish: Smooth.
5. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
6. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
7. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

C. Aluminum-Foil Laminate Jacket:
1. Manufacturers:
2. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
3. Finish: Aluminum smooth.
4. Comply with ASTM C1775.

D. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

2.09 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
1. Pipe Penetration Wall Seal: Airex Titan Outlet.
2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.

B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inch wide by 10 inch high (190.5 mm wide by 254 mm high).
   a. Elastomeric Sleeve Diameter: 1-11/16 inch (43 mm).
2. Wall Outlet Size, Siding and Compact Applications: 6-7/8 inch wide by 3-7/8 inch high (175 mm wide by 99 mm high).
   a. Elastomeric Sleeve Diameter: 1-11/16 inch (43 mm).
3. Outlet Cover Color: Gray.
4. Water Penetration: Comply with ASTM E331.
5. Air Leakage: Comply with ASTM E283/E283M.
6. Air Permeance: Comply with ASTM E2178.

C. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
1. PVC Insulation Cover Color: Black with full-length velcro fastener.
2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.

3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
5. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.
6. Carbon Arc Light Exposure: Comply with ASTM G153.
7. Tensile Strength After UV Exposure and Water Immersion: Comply with ASTM D412.
8. Water Absorption of Plastics: Comply with ASTM D570.
9. Adhesive free.

2.10 ACCESSORIES

A. General Requirements:
   1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
   2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
   4. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. **PVC or ABS Jacketing shall not be installed installed in return air plenums.**

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NAIMA National Insulation Standards.

D. Exposed Piping: Locate insulation and cover seams in least visible locations.

E. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

F. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

I. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

J. Inserts and Shields:
1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

M. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV-resistant finish for flexible elastomeric cellular insulation without jacketing.

N. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

O. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 HYDRONIC PIPING INSULATION

A. Piping Insulation Schedule

Hydronic Piping Systems	Insulation Types (1)	Density (lbs./cu ft.)	Insulation Thickness	Vapor Barrier Requirements (2)	Jacket Types (3)
HEATING WATER PIPING, UP TO 1-1/4” (100°F-140°F)	GF	3.5	1 INCH	YES	AP
HEATING WATER PIPING 1-1/2”AND LARGER (100°F-140°F)	GF	3.5	1-1/2 INCH	YES	AP
HEATING WATER PIPING, UP TO 1-1/4” (140°F-200°F)	GF	3.5	1-1/2 INCH	YES	AP
HEATING WATER PIPING 1-1/2”AND LARGER (140°F-200°F)	GF	3.5	2INCH	YES	AP

Hydronic Piping Systems	Insulation Types (1)	Density (lbs./cu ft.)	Insulation Thickness	Vapor Barrier Requirements (2)	Jacket Types (3)
STEAM AND CONDENSATE PIPING UPTO 3" (200°F-250°F OR 15 PSIG AND LESS)	GF	3.5	2-1/2 INCH	YES	AP
CORE LOOP AND CONDENSOR PIPING (60°F-100°F)	NONE	NONE	NONE	NONE	NONE
CHILLED WATER, GEOTHERMAL SUPPLY WATER, DARCY SUPPLY WATER PIPING UP TO 1-1/4” (40°F-60°F)	GF	3.5	1/2 INCH	YES	AP
CHILLED WATER, GEOTHERMAL SUPPLY WATER, DARCY SUPPLY WATER PIPING 1-1/2”AND LARGER (40°F-60°F)	GF	3.5	1INCH	YES	AP
CHILLED WATER, GEOTHERMAL RETURN WATER, DARCY RETURN WATER PIPING UP TO 6” (BELOW 40°F)	GF	3.5	1 INCH	YES	AP
CHILLED WATER, GEOTHERMAL RETURN WATER, DARCY RETURN WATER PIPING 8” AND LARGER (BELOW 40°F)	GF	3.5	1.5 INCH	YES	AP
COOLING CONDENSATE PIPING	GF	3.5	1/2 INCH	TES	AP
AIR SEPERATOR AND EXPANSION TANK	GF	3.5	2 INCH	Yes	AP
REFRIGERANT SUCTION PIPING	FE	-	1 INCH	NO	AL (EXTERIOR ONLY)
REFRIGERANT HOT GAS PIPING	NONE	-	-	NO	NONE
REFRIGERANT LIQUID PIPING	NONE	-	-	NO	NONE

(1) Key to Insulation Materials:
GF = Glass or Mineral Fiber
CG = Cellular Glass
FE = Flexible Elastomeric Foam

(3) Key to Jacket Requirements:
AP = All purpose foil, scrim, kraft paper jacket (white)
FSK = Foil, scrim, kraft paper jacket with foil

PF = Closed Cell Phenolic Foam
CS = Calcium Silicate
HTGF = High Temperature Glass Fiber
(2) Key to Vapor Barrier Requirements:
Yes = Required
None = Not Required
SJ = Continuous sealed joints required
finish
PVC = PVC Jacket
AL = Aluminum Jacket
SS = Stainless Steel Jacket
GC = Canvas or glass cloth

END OF SECTION

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SECTION 23 08 00
COMMISSIONING OF MECHANICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Testing Adjusting and Balancing
   2. Condensing Boilers
   3. Heat Exchangers
   4. Heating Water Piping
   5. Heating Water Pumps
   6. Energy Recovery Systems
   7. Packaged Rooftop Air Conditioning Units.
   8. Split-System Air-Conditioning Units
   9. Power Ventilators
   10. Water Treatment Systems
   11. General-Duty Valves for HVAC
   12. Hangers and Supports for HVAC
   13. Identification for HVAC
   14. HVAC Insulation
   15. Metal Ducts
   16. Nonmetal Ducts
   17. Duct Accessories

END OF SECTION

SECTION 23 09 34
VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

1.02 RELATED REQUIREMENTS

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.

D. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

E. NEMA IS 10033 - Adjustable Speed Drives; 2020 (Reapproved 2025).

F. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

G. NEMA IS 10035 - Application Guide for AC Adjustable Speed Drive Systems; 2021 (Reaffirmed 2025).

H. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

I. NEMA MG 00001 - Motors and Generators; 2024.

J. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

M. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. OCPD: Overcurrent protective device.

F. PID: Control action, proportional plus integral plus derivative.

G. RFI: Radio-frequency interference.

H. VFC: Variable-frequency motor controller.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: For each VFC indicated, include dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, required clearnaces and installed features and accessories.
   1. Include wiring diagrams showing factory and field connections.
   2. Identify mounting conditions required for equipment seismic qualification.

C. Specimen Warranty: Submit sample of manufacturer's warranty.

D. Manufacturer qualification statement.

E. Manufacturer's equipment seismic qualification certification.

F. Manufacturer's certification that products meet or exceed specified requirements.

G. Field quality control test reports.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.09 WARRANTY

A. Provide minimum five years from substantial completion manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB; Motion Business.

B. Danfoss.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. 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.

D. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range ; maximum voltage equals input voltage.

E. Variable-Frequency Motor Controller:
   1. Configuration: Packaged controller with across-the-line bypass.
   2. Power Conversion System: pulse-width-modulated inverter.
   3. Control Method: Vector; closed-loop, with feedback.
   4. Features:
      a. Factory built and tested in an enclosure.
      b. PID control.
      c. Integral disconnecting means.
      d. Overcurrent and overload protection.
      e. Listed and labeled by an NRTL as a complete unit.
      f. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for integrated short-circuit current (withstand).
      g. Arranged to provide self-protection.
      h. Variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
      i. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer..

F. Controller Assemblies: Comply with NEMA IS 10033, NEMA IS 10034, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

G. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA IS 10035, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
   1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
   2. Motor load type: Variable torque.
   3. Motor nameplate data.
   4. Requirements for speed control range, speed regulation, and braking.
   5. Motor suitability for bypass starting method, where applicable.

H. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

I. Operating Requirements:
   1. Input Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating..
   2. Input AC Voltage Unbalance: Not exceeding 3 percent.
   3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating..
   4. Efficiency: Minimum of 97 percent at full speed and load.
   5. Input Displacement Power Factor: Minimum of 98 percent under any speed or load range.

6. Short-Circuit Current (Withstand): Minimum of 10,000 A without fusing.
7. Ambient Temperature Rating: Not less than 32°F and not exceeding 104°F.
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet.
10. Vibration Withstand: Comply with NEMA ICS 61800-2.
11. Overload Rating:
    a. Variable Torque Loads: Minimum of 110 percent of nominal load for 60 seconds; and minimum of 135 percent of nominal load for 2 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; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

J. Power Conversion System: Microprocessor-based, pulse width modulation type, isolated from all power circuits.

K. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: Electrical.

L. 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.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

M. 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. Surge Suppression: Field-mounted surge suppressors complying with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits," UL 1449 SPD, Type 2.
3. 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.
4. Under- and overvoltage trips.
5. Inverter overcurrent trips.
6. 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.
7. Critical frequency rejection, with three selectable, adjustable deadbands.
8. Instantaneous line-to-line and line-to-ground overcurrent trips.
9. Loss-of-phase protection.
10. Reverse-phase protection.
11. Short-circuit protection.
12. Motor-overtemperature fault.

N. 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.

O. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

P. 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.

Q. 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.

R. 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.

S. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker 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. NC alarm contact that operates only when circuit breaker has tripped.

T. Control System:
   1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
   2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
   3. 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.
      a. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
      b. Security Access: Provide electronic security access to controls through identification and password with at least one level of access: View only; view and operate; and view, operate, and service.
         1) 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.
   4. Indicating Devices: Digital display mounted flush in VFC door and connected 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 torque (percent).
      e. Fault or alarming status (code).
      f. PID feedback signal (percent).
      g. DC-link voltage (V dc).

h. Set point frequency (Hz).
i. Motor output voltage (V ac).

5. Control Functions:
   a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
      1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
      2) Vector Control: Provide selectable autotuning function.
   b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
   c. Selectable braking control; DC injection or flux braking.
   d. Adjustable minimum/maximum speed limits.
   e. Adjustable pulse width modulation switching carrier frequency.
   f. Adjustable motor slip compensation.
   g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
   h. PID Control: Provide integral PID controller employing differential feedback for closed-loop control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation
      1) Number of Loops: One.
6. Status Indications:
   a. Power on.
   b. Motor run/stop status.
   c. Motor forward/reverse status.
   d. Local/remote control status.
   e. Output voltage.
   f. Output current.
   g. Output frequency.
   h. DC bus voltage.
   i. Motor speed.
7. Protective Functions/Alarm Indications:
   a. Overcurrent.
   b. Motor overload.
   c. Undervoltage.
   d. Overvoltage.
   e. Controller overtemperature.
   f. Input/output phase loss.
   g. Output short circuit protection.
   h. Output ground fault protection.
8. Electric Inputs:
   a. Digital Input(s): b. A minimum of six multifunction programmable digital inputs.
   b. Analog Input(s): A minimum of two programmable analog inputs: 4- to 20-mA dc .
9. 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. tentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

10. Outputs:
    a. Analog Output(s): A minimum of one programmable analog output signal(s) (4- to 20-mA dc), which can be configured for any of the following:.
        1) Output frequency (Hz).
        2) Output current (load).
        3) DC-link voltage (V dc).
        4) Motor torque (percent).
        5) Motor speed (rpm).
        6) Set point frequency (Hz).
11. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
    a. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.
12. Features:
    a. Password-protected security access.
    b. Event log.
13. Historical Logging Information and Displays:
    a. Real-time clock with current time and date.
    b. Running log of total power versus time.
    c. Total run time.
    d. Fault log, maintaining last four faults with time and date stamp for each.

U. Power Conditioning/Filtering:
1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

V. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Disconnect switch type.
    a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
    b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.

W. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
    a. Altitude: Less than 3,300 feet (1,000 m).
    b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

X. Short Circuit Current Rating:
1. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

Y. Conductor Terminations: Suitable for use with conductors to be installed.

Z. Enclosures:
1. Comply with NEMA IA 10030.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
   c. Kitchen Wash-Down Areas: Type 4X , stainless steel .
   d. Other Wet or Damp Indoor Locations: Type 4.
   e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
   f. Hazardous/Classified Locations: Type 7/9, as required for classification of installed location.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling Fan and Exhaust System: For NEMA 250, Type 1 ; UL 508 component recognized: Supply fan, with composite stainless steel intake and exhaust grills and filters; 120 -V ac; obtained from integral CPT.
5. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."
6. Enclosure Space Heaters:
   a. Provide in each controller enclosure installed outdoors and in unconditioned indoor spaces.
   b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   c. Heater Control: Thermostat.
   d. Heater Power Source: Provide connection to transformer factory-installed in enclosure or suitable external branch circuit as indicated or as required.

2.03 ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA IA 10039.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each bypass motor starter, minimum.

B. Pilot Devices:
1. Comply with NEMA IA 10039; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, nonilluminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, nonilluminated type with knob operator; number of switch positions as indicated or as required.
4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
1. Comply with NEMA IA 10039.
2. Provide number and type of relays indicated or required to perform necessary functions.
3. Timing Relays: Electronic.

D. 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.

E. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and connected auxiliary devices.
   2. Include primary and secondary fuses.

F. Supplemental Digital Meters:
   1. Elapsed-time meter.
   2. Kilowatt meter.
   3. Kilowatt-hour meter.

G. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install in accordance with NEMA IS 10034 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 23 05 29.

F. Install controllers plumb and level.

G. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches 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."

H. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches 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.

I. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

J. Provide grounding and bonding in accordance with electrical specifications

K. Install field-installed devices, components, and accessories.

L. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

M. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

N. Provide fuses complying with electrical specifications for fusible switches as indicated. Install fuses in each fusibile-switch VFC.

O. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

P. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

Q. Identify controllers in accordance with Section 23 05 53.

R. Comply with NECA 1.

3.02 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system.

B. Bundle, train, and support wiring in enclosures.

3.03 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in 23 05 53.
   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.

3.04 FIELD QUALITY CONTROL

A. Provide services of manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. 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.

D. 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 Architect 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. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. VFCs will be considered defective if they do not pass tests and inspections.

F. Correct deficiencies and replace damaged or defective controllers or associated components.

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.

3.05 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. 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.

C. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

D. 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 Architect before increasing settings.

E. Set the taps on reduced-voltage autotransformer controllers.

F. Set field-adjustable circuit-breaker trip ranges

G. Set field-adjustable pressure switches.

3.06 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.08 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION

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SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2019.

B. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

C. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

H. ASME B31.1 - Power Piping; 2024.

I. ASME B31.9 - Building Services Piping; 2020.

J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

L. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

U. AWWA C606 - Grooved and Shouldered Joints; 2022.

V. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

W. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

X. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

Y. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig minimum unless otherwise indicated.
   2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 5 psig, and is reduced to secondary pressure of 0.5 psig or less.

C. Siesmic 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.

1.05 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Valve Repacking Kits: One for each type and size of valve.

G. Warranty: Sample of special warranty.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
   1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, UNDERGROUND

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket, or three-layer coating of epoxy, adhesive, and double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black, Type E or S, Grade B.
   1. Fittings:
      a. ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
      b. Cold Press Mechanical Joint Fittings: ASTM A 420 / ASME B16.3, performance criteria ANSI LC4/CSA 6.32.
   2. Joints: Threaded or welded to ASME B31.1.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or L (B) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared Fittings. Comply with ASME B16.26 and SAE J513.
      a. Copper fittings with long nuts.
      b. Metal-to-metal compression seal without gasket.
      c. Dryseal threads complying with ASME B1.20.3.
   3. Joints: Copper Pressure-Seal-Joint.
      a. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
      b. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

C. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
   2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
   3. Coating: Polyethylene with flame retardant. Comply with ASTM E84.
      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: 50 or less.

4. Fittings: Provided by piping system manufacturer. Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.
8. Manufacturers:
   a. Omega Flex, Inc.
   b. Parker Hannifin Corporation; Parflex Division.
   c. Titeflex.
   d. Tru-Flex Metal Hose Corp.

2.03 UNIONS AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous Pipe: ASME B16.39, Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
   4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F (minus 29 degrees C to 82 degrees C).
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   1. Minimum Operating-Pressure Rating: 150 psig.
   2. Combination fitting of copper alloy and ferrous materials.
   3. Insulating materials suitable for natural gas.
   4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      a. Cold and Hot Pipe Sizes 6 Inches (150 mm) and Over: Double hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
   6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

a. Bases: High density polypropylene.
b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Other Types: As required.

2.05 BALL VALVES

A. Manufacturers:
1. Apollo Valves.
2. BrassCraft Manufacturing Company; a Masco company.
3. Conbraco Industries, Inc.; Apollo Div.
4. Grinnell Products.
5. Lyall, R. W. & Company, Inc.
6. McDonald, A. Y. Mfg. Co.
7. Milwaukee Valve Company.
8. Nibco, Inc.
9. Perfection Corporation; a subsidiary of American Meter Company.

B. Bronze Valves, NPS 3 and Smaller:
1. Construction: 2-piece.
2. Body: Bronze, complying with ASTM B584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze, blow-out proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Rating: 600 psig CWP.
8. Ends: Threaded complying with ASME B1.20.1, or flared complying with ASME B1.20.3.
9. Operator: Lever.
10. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
11. Service: Suitable for natural gas with "WOG" permanently marked on valve body.
12. Refer to "Piping Schedule" at end of section.

2.06 PLUG VALVES

A. Manufacturers:
1. AZ Valves USA.
2. Flowserve, Nordstrom.
3. Lee Brass Company..
4. McDonald, A. Y. Mfg. Co..

B. Bronze Valves, NPS 3 and Smaller:
1. Standards: MSS SP-78.
2. Body: Bronze, complying with ASTM B584.

3. Plug: Chrome-plated bronze.
4. Lubricated: Yes.
5. Packing: Teflow or Buna N.
6. Ends: Threaded complying with ASME B1.20.1.
7. Operator: Square head or lug type with lever operator.
8. Rating: Pressure class 125 psig.
9. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
10. Service: Suitable for natural gas.
11. Refer to "Piping Schedule" at end of section.

C. Iron Valves, NPS 4 and Larger:
1. Standards: ASME B16.1, B1610, A126, Class B, and MSS SP-78.
2. Body: Cast iron.
3. Plug: Gray iron.
4. Lubricated: Yes.
5. Cover Seal: Buna N.
6. Stem Seal: TFE.
7. Ends: Grooved or flanged complying with ASME B16.1/16.10.
8. Operator: Square head or lug type with locking wrench operator and stop collars.
9. Rating: Pressure class 125 psig.
10. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
11. Service: Suitable for natural gas.
12. Refer to "Piping Schedule" at end of section.

2.07 STRAINERS

A. Size 2 inch (50 mm) and Smaller:
1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 40-mesh stainless steel perforated screen and 50-percent free area.
2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 40-mesh stainless steel perforated screen 50-percent free area.

B. Size 1-1/2 inch (40 mm) to 4 inch (100 mm):
1. Class 125, flanged iron body, Y pattern with 40-mesh stainless steel perforated screen and 50-percent free area..

C. Size 5 inch (125 mm) and Larger:
1. Class 125, flanged iron body, basket pattern with 40-mesh stainless steel perforated screen and 50-percent free area..

2.08 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:
1. Actaris Metering Systems (A brand of ITT Controls).
2. American Meter Company.
3. Canadian Meter Company Inc.
4. Eaton Corporation; Controls Div.
5. Eclipse Combustion, Inc.
6. Fisher Control Valves and Regulators; Division of Emerson Process Management.
7. Harper Wyman Co.
8. Invensys.
9. Maxitrol Company.

10. Richards Industries; Jordan Valve Div.
11. SCP, Inc.

B. 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.

C. Compliance Requirements:
1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

D. Construction:
1. Housing: Die-cast aluminum.
2. Seals: Nitrile rubber resistant to gas impurities, abrasion and deformation at the valve port.
3. Diaphragm Plate: Zinc-plated steel.
4. Springs: Zinc-plated steel; interchangeable.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Finish: Factory-applied minimum three-layer polyester and polyurethane paint finish.

E. Vent:
1. Appliance Regulator: Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
2. Line Pressure Regulator: Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

F. Maximum Inlet Pressure:
1. Appliance Regulator: 2 psi (13.8 kPa).
2. Line Pressure Regulator: 2 psi (13.8 kPa).

G. Maximum Body Pressure: 10 psi (1000 mbar).

H. Output Pressure Range: 7 inch wc (17.4 mbar) to 14 inch wc (34.9 mbar).

2.09 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. 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.

2.10 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.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. 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.

B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

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 in accordance with manufacturer's instructions.

F. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

G. Verify final equipment locations for roughing-in.

H. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

I. At equipment connections, install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

J. Install piping to maintain headroom, conserve space, and not interfere with use of space.

K. Group piping whenever practical at common elevations.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

M. Connect branch piping from top or side of horizontal piping.

N. Comply with requirements in sections specifying gas-fired appliances and equipment for roughing-in requirements.

O. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

P. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

Q. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 31 00.

R. 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.

S. 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.

T. Establish elevations of buried piping outside the building to ensure not less than 4 ft (1.2 m) of cover.

U. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

V. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

W. Do not use natural-gas piping as grounding electrode.

X. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

Y. Provide support for utility meters in accordance with requirements of utility companies.

Z. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

AA. Install valves with stems upright or horizontal, not inverted.

BB. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

CC. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813.

DD. Sleeve pipes passing through partitions, walls and floors. Comply with requirements for sleeve seals specified in Division 23 Section "Common Work Results for HVAC."

EE. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Common Work Results for HVAC."

FF. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

GG. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.

2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 23 05 48.

HH. Steel Piping with Protective Coating:
1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

II. Copper Tubing with Protective Coating:
1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Install fittings for changes in direction and branch connections.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services.

E. Provide plug valves in natural gas systems for shut-off service.

F. Locate valves for easy access.

G. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

H. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

I. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.05 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. Threaded Joints:
1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.

2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. 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.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.06 SERVICE 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.

3.07 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. 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.

C. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.08 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to local building codes and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 SCHEDULES

A. Outdoor Piping:
1. Underground natural-gas piping shall be one of the following:

a. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
b. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

2. Aboveground natural-gas piping shall be one of the following:
   a. Steel pipe with malleable-iron fittings and threaded joints.
   b. Steel pipe with wrought-steel fittings and welded joints.
   c. Annealed-temper copper tube with wrought-copper fittings and brazed joints.
3. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

B. Indoor Piping:
1. Aboveground, branch piping NPS 2 and smaller shall be one of the following:
   a. Steel pipe with malleable-iron fittings and threaded joints.
   b. Steel pipe with cold press metallic fittings.
2. Aboveground, interior natural-gas piping, NPS 2-1/2 and larger shall be the following:
   a. Steel pipe with wrought-steel fittings and welded joints.

C. Underground Gas Shutoff Valve:
1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
2. Underground: Bronze plug valves.

D. Aboveground Gas Shutoff Valve:
1. Valves for pipe sizes NPS 3 and smaller at service meter shall be one of the following:
   a. Two-piece, regular-port, bronze ball valves with bronze trim.
   b. Bronze plug valve.
2. Distribution piping valves for pipe sizes NPS 3 and smaller shall be one of the following:
   a. Two-piece, regular-port, bronze ball valves with bronze trim.
   b. Bronze plug valve.
3. Distribution piping valves for pipe sizes NPS 4 and larger shall be one of the following:
   a. Iron plug valve.

E. Pipe Hanger Spacing:
1. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
2. Metal Piping:
   a. Pipe Size: 1/2 inches (15 mm) to 1 inches (25 mm):
      1) Maximum Hanger Spacing: 8 ft (2.4 m).
      2) Hanger Rod Diameter: 3/8 inches (9 mm).
   b. Pipe Size: 1-1/4 inches (32 mm) to 2 inches (50 mm):
      1) Maximum Hanger Spacing: 9 ft (2.7 m).
      2) Hanger Rod Diameter: 3/8 inch (9 mm).
   c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
      1) Maximum Hanger Spacing: 10 ft (3 m).
      2) Hanger Rod Diameter: 1/2 inch (13 mm).
   d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
      1) Maximum Hanger Spacing: 10 ft (3 m).
      2) Hanger Rod Diameter: 5/8 inch (15 mm).
   e. Pipe Size: 8 inches (200 mm) to 12 inches (300 mm):
      1) Maximum Hanger Spacing: 14 ft (4.25 m).
      2) Hanger Rod Diameter: 7/8 inch (22 mm).

f. Pipe Size: 14 inches and Over (350 mm and Over):
   1) Maximum Hanger Spacing: 20 ft (6 m).
   2) Hanger Rod Diameter: 1 inch (25 mm).

3. Corrugated Stainless-Steel Tubing:
   a. Pipe Size: NPS 3/8 inches (9 mm):
      1) Maximum Hanger Spacing: 4 feet (1.2 m)
      2) Hanger Rod Diameter: 3/8 inch (9 mm).
   b. Pipe Size: NPS 1/2 inches (13 mm):
      1) Maximum Hanger Spacing: 6 ft (1.8 m).
      2) Hanger Rod Diameter: 3/8 inch (9 mm).
   c. Pipe Size: NPS 3/4 inches (19 mm) and Larger:
      1) Maximum Hanger Spacing: 8 ft (2.4 m).
      2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

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SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.
   4. Characterized control valves
   5. Pressure independent control valves and balancing valves.

G. Bypass Chemical Feeder

1.02 RELATED REQUIREMENTS

A. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

B. Section 23 05 23 - General-Duty Valves for HVAC Piping.

C. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment

D. Section 23 05 53 - Identification for HVAC Piping and Equipment.

E. Section 23 07 19 - HVAC Piping Insulation.

F. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2024.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.

H. ASME B31.9 - Building Services Piping; 2020.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

J. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

L. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

M. ASTM B32 - Standard Specification for Solder Metal; 2020.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

P. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

Q. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

R. ASTM F3226/F3226M - Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems; 2019 (Reaffirmed 2024).

S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

T. AWS D10.12M/D10.12 - Guide for Welding Mild Steel Pipe; 2000.

U. AWWA C606 - Grooved and Shouldered Joints; 2022.

V. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

W. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SUBMITTALS

A. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.
   3. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
   1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.06 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Source quality-control reports
   3. Field quality-control reports.
   4. Warranty: Sample of special warranty.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
         1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
         2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
      c. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated and at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) ball valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   3. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.
   3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
   4. Mechanical Press Sealed Fittings: ASTM F3226/F3226M, ICC (IMC), and IAPMO (UMC) approved, with EPDM seals.

B. Steel Pipe Sizes 12 Inches (305 mm) and Greater: ASTM A53/A53M, 3/8 inch (9.5 mm) wall, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D10.12M/D10.12 welded.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
   2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Greater: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   14. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
   15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   16. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   17. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

B. Dielectric Connections:
1. Flanges:
a. Dielectric flanges with same pressure ratings as standard flanges.
b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
c. Dry insulation barrier able to withstand 600-volt breakdown test.
d. Construct of galvanized steel with threaded end connections to match connecting piping.
e. Suitable for the required operating pressures and temperatures.
2. Unions:
a. 1/2 to 1 Inches (15 to 25 mm): Brass solder to galvanized FPT.
b. 1/2 to 2 Inches (15 to 50 mm): Brass solder to galvanized FPT.
c. 1/2 to 1 Inches (15 to 25 mm): Brass to galvanized FPT or FIP (Female Iron Pipe).
d. 3/4 to 1/2 Inch (20 to 15 mm) Reducer: Brass solder to galvanized FPT.
e. Service: 250 psi (1,723.6 kPa), minus 20 to 180 deg F (minus 28.9 to 82.2 deg F).

2.06 BALL VALVES

A. Up To and Including 2 Inches (50 mm):
1. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, joining ends compliant pipe materials.

B. Over 2 Inches (50 mm):
1. Ductile iron body, chrome plated stainless steel ball, teflon seat and stuffing box seals, lever handle or gear operated, grooved ends, rated to 800 psi (5515 kPa).

2.07 BUTTERFLY VALVES

A. Body: Cast or ductile iron with resilient replaceable EPDM seat, lug or grooved ends, extended neck.

B. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

C. Stem: Stainless steel with stem offset from the centerline to provide full 360-degree circumferential setting.

D. Operator: 10 position lever handle.

2.08 SWING CHECK VALVES

A. Up To and Including 2 Inches (50 mm):
1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.

B. Over 2 Inches (50 mm):
1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.

2.09 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

2.10 CHARACTERIZED CONTROL VALVES

A. Manufacturers:
   1. Belimo

B. Control Valves: Factory-fabricated, characterized control valves (CCVs), designed to provide accurate flow control based on valve position and system demand. Valves shall be suitable for HVAC applications and meet the following criteria:
   1. Maintain proportional and linear flow control across full stroke of actuator.
   2. Characterized control to modulate flow from 0 to 100 percent, with an operating pressure differential range appropriate to system design.
   3. Provide ANSI/FCI 70-2 Class 4 shut-off on all sizes and serviceable.
   4. Provide valves for use with hydronic systems, including chilled water, hot water, and glycol mixtures, with the following characteristics:
      a. 2” NPS (50 DN) and Smaller: Bronze or brass body, stainless steel or brass trim, threaded or sweat connections.
      b. 2-1/2” NPS (65 DN) and Larger: Ductile iron body, stainless steel or brass trim, flanged or grooved end connections.
      c. Characterized Disc: Insert or internal component to ensure equal percentage or linear flow characteristics, depending on actuator signal.
      d. Pressure Rating: Minimum 250 psig working pressure.
      e. Temperature Rating: 32 to 250 degrees F (0 to 121 degrees C).
   5. Sizing: Line-size or as scheduled.
   6. End Connections and Adapters: Factory-compatible with ANSI standards; valves 8-inch (200 mm) and below to be provided with factory companion flanges or unions.

C. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.

D. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
   1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
   2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
   3. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
      a. Fail Position: Closed
   4. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 watts at 24 VDC.
   5. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 watts at 24 VDC.
   6. Proportional Signal: 0 to 10 VDC or 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.
   7. Provide plenum-rated actuators for service above ceilings to possess UL listings and approvals.
   8. Temperature Rating: 40 to 104 degrees F (4.5 to 40 degrees C).

2.11 PRESSURE INDEPENDENT CONTROL VALVES AND BALANCING VALVES

A. Manufacturers:
   1. Belimo.

B. Control Valves: Factory-fabricated pressure independent with internal differential pressure regulator (DPRV), which automatically adjusts to normal changes in system pressure and provides 100 percent control valve authority at all positions of the valve.
   1. Maintain proportional and linear flow coil characteristics.
   2. PICV to accurately control the flow from 0 to 100 percent full rated flow with an operating pressure differential range of 3 to 60 psig (21 to 414 kPa).

3. Provide ANSI/FCI 70-2 Class 4 shut-off on all sizes and field serviceable.
4. Provide control valve to incorporate control, balancing, and flow limiting. Hydronic system pressure independent control valve bodies to comply with ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure and have the following characteristics:
    a. 2 NPS (50 DN) and Smaller: Class 150 bronze or brass body with union connections, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, and screwed ends with backseating capacity repackable under pressure.
    b. 2-1/2 NPS (65 DN) and Larger: Class 125 iron or ductile iron body, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, flanged ends with backseating capacity repackable under pressure.
    c. Pressure Control Seat: Brass construction with vulcanized EPDM.
    d. Sizing: Line-size.
    e. Fittings and Components: All fittings and components to meet ANSI standards and be compatible with readily available components. 8-inch (200 mm) valves and above to be provided with proper companion flanges.
    f. Close-Off (Differential) Pressure Rating: Combination of actuator, DPRV action, and trim to provide a minimum close-off pressure rating of 150 percent of total system (pump) head. Provide actuator from the same manufacturer as the pressure independent control valve.

C. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.

D. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
3. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
    a. Fail Position: Closed
4. Power Requirements (Two-Position Spring Return): 24 VAC.
5. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 watts at 24 VDC.
6. Proportional Signal: 0 to 10 VDC or 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.
7. Provide plenum-rated actuators for service above ceilings to possess UL listings and approvals.
8. Temperature Rating: 40 to 104 degrees F (4.5 to 40 degrees C).

2.12 BYPASS CHEMICAL FEEDER

A. Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Indicated piping locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

C. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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. Install in accordance with manufacturer's instructions.

H. Install piping to permit valve servicing.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. 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.

M. Route piping in orderly manner, parallel to building structure, and maintain gradient.

N. Install piping to conserve building space and to avoid interference with use of space.

O. Group piping whenever practical at common elevations.

P. Install piping at indicated slopes. Slope piping and arrange to drain at low points.

Q. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

R. Install piping free of sags and bends.

S. Install fittings for changes in direction and branch connections.

T. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

U. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

V. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

W. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

X. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 23 05 16.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.

Y. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

Z. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

AA. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.

BB. Provide access where valves and fittings are not exposed.

CC. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

DD. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. See Section 09 91 23.

EE. Install valves with stems upright or horizontal, not inverted.

3.03 JOINT CONSTRUCTION

A. 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.

B. 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.

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 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.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. 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.

F. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.04 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. Install drain valve on air separators NPS 2 and larger.

C. Install bypass chemical feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

3.05 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.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.06 FIELD QUALITY CONTROL

A. Prepare hydronic piping for testing, according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
   3. Use unheated 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.
   4. 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.
   5. 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.
   6. Isolate expansion tanks and determine that hydronic system is full of water.
   7. 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. 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 "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
   2. 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.
   3. 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. Set temperature controls so all coils are calling for full flow.
5. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
6. Verify lubrication of motors and bearings.

3.07 CHEMICAL TREATMENT

A. System Flushing and Fill:
   1. The Mechanical Contractor is responsible to flush, clean and fill the closed loop Hydronic system as noted below. In addition the Mechanical Contractor is responsible to coordinate the testing of the fill water and to install chemical additions as provided by LTF's water treatment Contractor, International Chemtex (contact Ron Phares 651-968-7768) prior to starting the boiler system.

B. Chemical Flushing:
   1. The system cleaner shall be 9320 by International Chemtex or approved equal.
   2. Drain the system after the required circulation period as quickly as possible, this will prevent settling of foulants. Run circulating pumps and flush with clean water until the discharge water is clear.
   3. When system water is clear, remove, clean and replace all strainers.

3.08 HANGER SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2-1/2 Inches (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   5. 3 Inches (80 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Piping.
   1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9 mm).
   2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 1/2 inch (13 mm).
   6. 3 Inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 1/2 inch (13 mm).
   7. 4 Inches (100 mm): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
   8. 6 Inches (150 mm): Maximum span, 17 feet (5.1 m); minimum rod size, 1/2 inch (13 mm).
   9. 8 Inches (200 mm): Maximum span, 19 feet (5.8 m); minimum rod size, 5/8 inch (16 mm).
   10. 10 Inches (250 mm): Maximum span, 20 feet (6.1 m); minimum rod size, 3/4 inch (19 mm).
   11. 12 Inches (300 mm): Maximum span, 23 feet (7.0 m); minimum rod size, 7/8 inch (22 mm).
   12. 14 Inches (350 mm): Maximum span, 25 feet (7.6 m); minimum rod size, 1 inch (25 mm).
   13. 16 Inches (400 mm): Maximum span, 27 feet (8.2 m); minimum rod size, 1 inch (25 mm).

14. 18 Inches (450 mm): Maximum span, 28 feet (8.5 m); minimum rod size, 1-1/4 inches (38 mm).
15. 20 Inches (500 mm): Maximum span, 30 feet (9.1 m); minimum rod size, 1-1/4 inches (38 mm).

C. Hanger Spacing for Plastic Piping.
1. 1/2 Inch (15 mm): Maximum span, 42 inches (1000 mm); minimum rod size, 1/4 inch (6 mm).
2. 3/4 Inch (20 mm): Maximum span, 45 inches (1100 mm); minimum rod size, 1/4 inch (6 mm).
3. 1 Inch (25 mm): Maximum span, 51 inches (1300 mm); minimum rod size, 1/4 inch (6 mm).
4. 1-1/4 Inches (32 mm): Maximum span, 57 inches (1400 mm); minimum rod size, 3/8 inch (9 mm).
5. 1-1/2 Inches (40 mm): Maximum span, 63 inches (1600 mm); minimum rod size, 3/8 inch (9 mm).
6. 2 Inches (50 mm): Maximum span, 69 inches (1700 mm); minimum rod size, 3/8 inch (9 mm).
7. 3 Inches (80 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9 mm).

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compression tanks.
B. Expansion tanks.
C. Air vents.
D. Air/dirt separators.
E. Hydraulic separators/buffer tanks.
F. Strainers.
G. Magnetic filters.
H. Suction diffusers.
I. Pump connectors.
J. Triple Duty Valves.
K. Pressure-temperature test plugs.
L. Calibrated balancing valves (circuit setters).
M. Automatic balancing/limiting valves.
N. Relief valves.
O. Pressure reducing valves.
P. Condensate acid neutralizer.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
C. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023, with Errata (2024).

1.04 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project.
    1. Product description, make/model, and dimensions.
    2. Component sizes, rough-in requirements, service sizes, and finishes.
    3. Rated capacities, operating characteristics, and furnished specialties and accessories.
    4. Flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.06 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. 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

2.01 COMPRESSION TANKS

A. Manufacturers:
   1. American Wheatley, a Company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
   2. Amtrol Inc: www.amtrol.com/#sle.
   3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   4. Taco, Inc: www.taco-hvac.com/#sle.

B. Construction: Closed, welded steel, tested, and stamped in accordance with ASME BPVC-VIII-1; cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
   1. Pressure Rating: 125 psi (860 kPa).

C. Gauge Glass Set: Brass compression stops, guard, and 3/4 inch (20 mm, DN) glass, maximum 24 inches (600 mm, DN) length, long enough to cover tank for 2 inches (50 mm, DN) above bottom to 2 inches (50 mm, DN) below top.

D. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.

E. Air-Control and Drain Fitting: Include drain fitting and taps for pressure gage and air-charging fitting.

F. Support: Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles.

G. Quality Control: Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

H. Automatic Cold Water Fill Assembly: Provide where shown on plan; pre-mixed glycol systems shall not have automatic cold water fill. Include pressure reducing valve, RPZ ,backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.02 EXPANSION TANKS

A. Manufacturers:
   1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
   2. Amtrol Inc: www.amtrol.com/#sle.
   3. Calefactio Solutions, Inc.: www.calefactio.com/#sle
   4. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   5. Taco, Inc: www.taco-hvac.com/#sle.

B. Maximum Rated Working Pressure: 125 psi (860 kPa).

C. Maximum Allowable Service Temperature: 240 degrees F (115.6 degrees C).

D. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, adjustable flexible EPDM diaphragm or bladder seal (as scheduled on drawings) factory precharged to 50 psi (345 kPa), and steel support stand.

E. Automatic Cold Water Fill Assembly: Provide where shown on plan; pre-mixed glycol systems shall not have automatic cold water fill. Include pressure reducing valve, RPZ backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

F. Accessories: Provide air-charging fitting, bulls eye sight glass, pressure gauge, and tank drain ball valve.

2.03 AIR VENTS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Calefactio Solutions, Inc.: www.calefactio.com/#sle
4. Flamco: www.flamcogroup.us/#sle.
5. Taco, Inc: www.taco-hvac.com/#sle.

B. Manual Air Vent:
1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.

C. Maximum Fluid Pressure: 150 psi (1,034 kPa).

D. Maximum Fluid Temperature: 250 degrees F (121.1 degrees C).

2.04 AIR/DIRT SEPARATORS

A. Coalescing Air/Dirt Separators:
1. Manufacturers:
a. Spirotherm, Inc: www.spirotherm.com/#sle.
2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1 for maximum fluid service subject to application requirements and manufacturer's standard maximum operating conditions.
3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi (1,034 kPa), threaded to top of separator.
5. End Connections: Class 150 flanged for 2-1/2 inch (65 mm, DN) and larger otherwise threaded.
6. Blowdown Connection: Threaded.
7. Size: As indicated on drawings.
8. Maximum Fluid Service Pressure: 150 psi (1,034 kPa).
9. Maximum Fluid Service Temperature: 250 degrees F (121.1 degrees C).
10. Centrifugal-style separators are not allowed.

2.05 HYDRAULIC SEPARATORS/BUFFER TANKS

A. Buffer Tanks:
1. Manufacturers:
a. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
b. Amtrol, Inc.: www.amtrol.com/#sle..
c. AO Smith: www.hotwater.com/#sle.

d. Calefactio Solutions, Inc.: www.calefactio.com/#sle
e. Lochinvar: www.lochinvar.com/#sle.
f. Taco, Inc.: www.taco-hvac.com/#sle.

2. Carbon-steel based, primer-base coated vertical-mounted buffer tank with flanged inlet-outlet pipe connections, and ASME BPVC-VIII-1 tested and stamped for maximum allowed operating pressure of 125 psi (861.8 kPa).
3. Flow Rate Capacity: As indicated on drawings.
4. Pipe Connections: Flanged.
5. Air Vent: Automatic.
6. Drain: Ball type drain valve.

B. Coalescing Hydraulic Separators:
1. Manufacturers:
a. Spirotherm, Inc.: www.spirotherm.com/#sle..
2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1 for maximum fluid service subject to application requirements and manufacturer's standard maximum operating conditions.
3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi (1,034 kPa), threaded to top of separator.
5. End Connections: Class 150 flanged for 2-1/2 inch (65 mm, DN) and larger otherwise threaded.
6. Blowdown Connection: Threaded.
7. Size: As indicated on drawings.
8. Maximum Fluid Service Pressure: 150 psi (1,034 kPa).
9. Maximum Fluid Service Temperature: 250 degrees F (121.1 degrees C).

2.06 STRAINERS

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
2. Armstrong International, Inc: www.armstronginternational.com/#sle.
3. The Metraflex Company: www.metraflex.com/#sle.
4. Watts Water Technologies: www.watts.com/#sle .

B. Size 2 inch (50 mm, DN) and Under:
1. Provide threaded for up to 175 psi (1,200 kPa) working pressure and up to 250 degrees F working temperature.
2. Body Material by Fluid Service:
a. Stainless Steel:
1) Steam: Up to 600 psi at 486 degrees F (4,136.8 kPa at 252.2 degrees C).
2) Liquids: Up to 1,440 psi at 100 degrees F (9,928.4 kPa at 37.8 degrees C).

C. Size 2-1/2 inch (65 mm, DN) and larger:
1. Provide flanged for up to 175 psi (1,200 kPa) working pressure and up to 250 degrees F working temperature.
2. Body Material by Fluid Service:
a. Stainless Steel:
1) Liquids: Up to 285 psi at 100 degrees F (1,965 kPa at 37.8 degrees C).

D. Body: Bolted cover and bottom drain connection.

E. Screen: Y-pattern strainer with 40-mesh stainless steel perforated screen.

F. Performance: Capable of 3/4-inch misalignment.

2.07 SUCTION DIFFUSERS

A. Manufacturers:
   1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
   2. Armstrong Fluid Technologies: www.armstrongfluidtechnologies.com/#sle
   3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   4. Grundfos Pumps Corporation: www.grundfos.com/#sle
   5. Taco, Inc.: www.taco-hvac.com/#sle.
   6. Victaulic Company of America: www.victaulic.com/#sle.

B. Description: Horizontally or vertically mounted angle-pattern fitting with integral-cast vanes, fine particle mesh screen and drain plug.

C. Body: Cast iron or ductile iron.

D. Connections: AMSE/ANSI Class 125 flanges,
   1. Inlet: Matches system pipe size.
   2. Outlet: Matches pump inlet size.

E. Pressure: 175 psi (1200 kPa) working pressure

F. Temperature: 250 degree F (120 degree C)

G. Strainer Mesh:
   1. Start-up: Disposable bronze 16-Mesh.
   2. Permanent: 304 stainless steel.

H. Cover: Removable cover plate with reusable EPDM o-ring.

I. Magnetic Filter: No.

2.08 PUMP CONNECTORS

A. Manufacturers:
   1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
   2. Anvil International; AnviFlex: www.anvilintl.com/#sle.
   3. FNW: www.fnw.com/#sle.
   4. Mason Industries, Inc.: www.mason-ind.com/#sle
   5. The Metraflex Company: www.metraflex.com/#sle.

B. Flexible Connectors: Flanged, braided type, sized to match piping.
   1. Braid: 304 stainless steel braid and braid bands.
   2. Wetted components: 304 stainless steel hose.
   3. Maximum Operating Service: 150 psi (1030 kPa) at 240 degrees F (115.6 degrees C).
   4. Accommodate the Following:
      a. Length: 12 inche nominal, 9-3/4 inch live length.
      b. Maximum Lateral Offset: 1/8 inch (3 mm).
      c. Force developed by 1.5 times specified maximum allowable operating pressure.
   5. End Connections: Flanged carbon steel.
   6. Provide necessary accessories.

2.09 TRIPLE-DUTY VALVES

A. Manufacturers:
   1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
   2. Anvil International: www.anvilintl.com/#sle.
   3. Bell & Gossett, a brand of Xylem, Inc.: www.bellgossett.com/#sle.
   4. Taco, Inc: www.taco-hvac.com/#sle.
   5. Victaulic Company of America: www.victaulic.com/#sle.

B. Class 125:
   1. Maximum Service Operation: 175 psi (1,200 kPa), 250 degrees F (121 degrees C).

C. Triple-Duty Globe Type: Flanged cast-iron angle pattern body with bolt-on bonnet, position indicator, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, metering connectors, flow shutoff mechanism, adjustable flow handle, and integrated pressure and temperature ports.

2.10 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. FNW: www.fnw.com/#sle.
   2. Peterson Equipment Company Inc: www.petesplug.com/#sle.
   3. Sisco Manufacturing Company Inc: www.siscomfg.com/#sle.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F (93 degrees C).

C. Application: Use extended length plugs to clear insulated piping.

2.11 CALIBRATED BALANCING VALVES (CIRCUIT SETTERS)

A. Manufacturers:
   1. Macon, a brand of Tunstall Corporation: www.tunstall-inc.com/#sle

B. Size 2 inch (50 mm, DN) and Smaller:
   1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and NPT threaded connections.
   2. Body: bronze or brass.
   3. Maximum Service Operation: 300 psi at 250 degrees F (2,068 kPa at 121.1 degrees C).

C. Size 2-1/2 inch (65 mm, DN) and Larger:
   1. Provide ball, globe, or butterfly style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and ANSI Class 125 flanged connections.
   2. Body: cast iron, carbon steel, or ductile iron.

D. Construction:
   1. Gaskets: EPDM.
   2. Seat Seal: PTFE
   3. Handwheel: Engineered plastic.
   4. Positive shutoff and memory stop.

2.12 AUTOMATIC BALANCING/LIMITING VALVES

A. Manufacturers:
   1. Armstrong International: www.armstronginternational.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Griswold Controls LLC: www.griswoldcontrols.com/#sle.
   4. Hays Fluid Controls; Mesurflo Balancing Valve: www.haysfluidcontrols.com/#sle.

5. Nexus Valve, Inc: www.nexusvalve.com/#sle.
6. Taco Inc: www.taco-hvac.com/#sle.

B. Construction:
1. Brass, bronze, or iron body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
2. Built-in lug-type outlet butterfly valve with 2-position handle.

C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

D. Control Mechanism: Provide stainless steel or nickel-plated, brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.

E. Size: As indicated on drawings.

F. Accessories: Provide hanging tag, inlet in-line strainer, outlet ball valve, and PT test plug extension.

2.13 RELIEF VALVES

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Armstrong International, Inc: www.armstronginternational.com/#sle.
4. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
5. Calefactio Solutions, Inc.: www.calefactio.com/#sle.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.14 PRESSURE REDUCING VALVES

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.americanwheatley.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Armstrong International, Inc: www.armstronginternational.com/#sle.
4. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
5. Taco, Inc: www.taco-hvac.com/#sle.

B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 21 13.

C. Materials of Construction:
1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
2. Internal Components: Construct of stainless steel or brass and engineered plastics or composition material.

D. Connections:
1. NPT threaded: 1/2 inch (15 mm, DN) or 3/4inch (20 mm, DN).

E. Provide integral check valve and strainer.

F. Maximum Inlet Pressure: 400 psi (2,758 kPa).

G. Maximum Fluid Temperature: 180 degrees F (82 degrees C).

H. Adjustable Pressure Range: From 10 to 45 psi (69 to 310.3 kPa), set to 25 psi (172 kPa).

2.15 CONDENSATE ACID NEUTRALIZER

A. Manufacturers:
   1. Calefactio Solutions, Inc.: calefactio.com
   2. JJM Alkaline Technologies; NBT-Series and NB-Series: jjmalkalinetech.com

B. Description: Neutralize acidity of condensate from condensate-producing equipment.

C. Tank: Corrosion-resistant materials, removable lid.

D. Medium: Refillable pH power pellets.

E. Connections: NPT inlet and outlet sized as required for connected capacity.

F. Pump: Integral, only when required per drawings.

PART 3 EXECUTION

3.01 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install throttling-duty valves at each branch connection to return main.

C. Install calibrated balancing valves in the return pipe of each heating or cooling terminal where not using pressure independent control valves.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.02 HYDRONIC SPECIALTY INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points, at heat-transfer coils, and as indicated on the drawings.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blowdown and dirt separator connections.

F. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

G. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

H. Support pump fittings with floor-mounted pipe and flange supports.

I. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks, hot water generators, and elsewhere as required by ASME Boiler and Pressure Vessel Code.

J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Pipe relief valve outlet to nearest floor drain or as indicated on the drawings. Where discharge may exceed 140 degrees F provide drain tempering valve. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

L. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

M. Install pressure-reducing valves at makeup-water connections, including glycol fill lines, to regulate system fill pressure.

N. Install control valves and flow meters with manufacturer recommended minimum straight pipe upstream and downstream without fittings, valves or obstructions.

O. Where pressure independent control valves are specified but size or flow exceed manufacturer products, inline flow meter paired with pressure dependent control valve shall be used.

P. Install full-size bypass piping with ball valve or butterfly valve, depending on pipe size, around flow meters for serving flow meter.

Q. Install floor-set equipment on four-inch concrete housekeeping pads, or as indicated on the drawings.

R. Install condensate neutralizers on boilers and where shown on drawings.

END OF SECTION

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SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line pumps.

B. End-suction pumps.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 07 16 - HVAC Equipment Insulation.

C. Section 23 07 19 - HVAC Piping Insulation.

D. Section 23 09 34 - Variable-Frequency Motor Controllers for HVAC.

E. Section 23 21 13 - Hydronic Piping.

F. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.05 CLOSEOUT SUBMITTALS

A. Millwright's Certificate: Certify that base mounted pumps have been aligned.

B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.

C. EBARA Pumps Americas Corporation: www.pumpsebara.com

D. Grundfos Pumps Corporation: www.grundfos.com/#sle.

E. Taco Comfort Solutions: www.tacocomfort.com.

2.02 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Base Mounted Pumps: Aligned by qualified millwright.

D. Electrical Requirements:
   1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.
   2. Variable Frequency Drives (VFDs): Provide in accordance with Section 23 09 34, except for integral-VFDs.

2.03 IN-LINE PUMPS

A. Closed-Coupled, Single-Stage Pump: Vertical pump with radially-split casing; rated for discharge pressures up to 175 psi (1200 kPa).

B. Split-Coupled, Single-Stage Pump: Vertical pump with radially-split casing; rated for discharge pressures up to 175 psi (1200 kPa).

C. Split-Coupled, Multi-Stage: Vertical pump with radially-split casing, integral controls, bottom mount suction, and discharge pipe connections with gauge ports rated for discharge pressures up to 580 psi (3999 kPa).

D. Casing: Cast iron with seal flush connection, flanged suction, and discharge ports with gauge port and drain plug.

E. Impeller: Stainless steel, fully enclosed, keyed directly to motor shaft or extension.

F. Shaft: Stainless steel with stainless steel impeller cap screw or nut and stainless steel sleeve.

G. Seal: Mechanical seal, 225 degrees F (107 degrees C) maximum continuous duty temperature.

H. Performance: As indicated on drawings.

I. Electrical:
   1. Motor: Electronically computated motor (ECM), 1,750 rpm, open drip-proof (ODP); see Section 23 05 13.
   2. Integral Controls:
      a. BAS, SCADA, or Other Integrated Automation Link: BACnet MS/TP in accordance with ASHRAE Std 135.
      b. Pump curves for fixed speed, proportional control, and constant pressure with selector knob.
      c. Status/fault indicators.
      d. Control mode button.
      e. Numeric display.

2.04 END-SUCTION PUMPS

A. Split-Coupled Pump: Base-mounted, single-stage pump with horizontal shaft and radially-split casing rated for discharge pressures up to 175 psi (1200 kPa).

B. Close-Coupled Pump: Base-mounted, single-stage pump with horizontal shaft and radially-split casing rated for discharge pressures up to 360 psi (2482 kPa).

C. Casing: Cast iron or ductile iron with renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction, and discharge flanged connections with gauge ports.

D. Impeller: Stainless steel, balanced, fully enclosed, keyed to shaft.

E. Bearings: Permanently lubricated roller or ball bearings.

F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

G. Seal: Mechanical, 225 degrees F (107 degrees C) maximum continuous duty temperature.

H. Drive: Flexible coupling with coupling guard.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

J. Performance: As indicated on drawings.

K. Electrical:
   1. Motor: 1,750 rpm, total-enclosed, fan-cooled (TEFC); see Section 23 05 13.
   2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Comply with HI 1.4.

B. Install in accordance with manufacturer's instructions.

C. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

D. Support piping adjacent to pump such that no weight is carried on pump casings. For base-mounted pumps, provide supports under elbows on pump suction and discharge lines.

E. Independently support inline pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

F. Suspend inline pumps from wall brackets and continuous-thread hanger rods with spring hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

G. Provide line sized shut-off valve and suction diffuser on pump inlet, and line sized triple duty valve or shut-off valve with check valve and calibrated balancing valve on pump discharge.

H. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

I. Provide air cock and drain connection on horizontal pump casings.

J. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

K. Provide drains for bases and seals, piped to and discharging into floor drains.

L. Check, align, and certify alignment of base-mounted pumps prior to start-up.

M. Install base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place.

N. Controls: Interface each pump starter or VFD with building automation system..

END OF SECTION

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Nonmetal ducts.

D. Air plenums and casings.

E. Ducts for kitchen exhaust applications.

1.02 RELATED REQUIREMENTS

A. Section 23 01 30.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

C. Section 23 33 00 - Air Duct Accessories.

D. Section 23 36 00 - Air Terminal Units.

E. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

I. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

J. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

K. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

L. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

N. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

O. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

P. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

Q. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

R. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

S. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

T. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

U. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

V. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

C. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meets or exceed specified requirements.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   2. Rectangular: Plus or minus 4 in-wc (995 Pa) of galvanized steel.
   3. Flat Oval: Plus 2 in-wc (500 Pa) of galvanized steel.

4. Fibrous Glass Duct-board: Plus or minus 2 in-wc (500 Pa).
5. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc (125 Pa); see Section 23 37 00.

D. Duct Sealing and Leakage in accordance with Static Pressure Class:
1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
   a. Supply Air:
      1) Air Handling Units: 3 in-wc (750 Pa) pressure class, galvanized steel.
      2) Fan Coil Units: 1 in-wc (250 Pa) pressure class, galvanized steel.
      3) Heat Pumps: 1 in-wc (250 Pa) pressure class, galvanized steel.
      4) Rooftop Units: 3 in-wc (750 Pa) pressure class, galvanized steel.
      5) Self-Contained Units: 1 in-wc (250 Pa) pressure class, galvanized steel.
      6) Terminal Units: 1 in-wc (250 Pa) pressure class, galvanized steel.
   b. Outside Air Intake: 1 in-wc (250 Pa) pressure class, galvanized steel.
   c. Return Air:
      1) Air Handling Units: 2 in-wc (500 Pa) pressure class, galvanized steel
      2) Fan Coil Units: 1 in-wc (250 Pa) pressure class, galvanized steel
      3) Heat Pumps: 1 in-wc (250 Pa) pressure class, galvanized steel
      4) Rooftop Units: 2 in-wc (500 Pa) pressure class, galvanized steel
      5) Self-Contained Units: 1 in-wc (250 Pa) pressure class, galvanized steel
      6) Terminal Units: 1 in-wc (250 Pa) pressure class, galvanized steel
   d. Relief Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
   e. Exhaust Air:
      1) Dishwasher Exhaust: 1 in-wc (250 Pa) pressure class, aluminum.
      2) General Exhaust: 1 in-wc (250 Pa) pressure class, galvanized steel.
      3) Grease Exhaust: 3 in-wc (750 Pa) pressure class, 16-ga welded steel.
   f. Heating or Combustion Air: 1 in-wc (250 Pa) pressure class, galvanized steel.
   g. Transfer Air and Sound Booths: 1/2 in-wc (125 Pa) pressure class, galvanized steel, fibrous glass liner.
2. Seal Class Definitions:
   a. Class C: Apply sealing of traverse joints only.
   b. Class B: Apply sealing of traverse joints and longitudinal seams.
   c. Class A: Apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
3. Low Pressure Service: 1/2 in-wc (125 Pa) to 1 in-wc (250 Pa)
   a. Seal: Class A
   b. Leakage:
      1) Rectangular: Class 6, rate according to Table 1 (Table 2) below.
      2) Round: Class 3, rate according to Table 1 (Table 2) below.
4. Low Pressure Service: 2 in-wc (500 Pa):
   a. Seal: Class A
   b. Leakage:
      1) Rectangular: Class 6, rate according to Table 1 (Table 2) below.
      2) Round: Class 3, rate according to Table 1 (Table 2) below.
5. Medium Pressure Service: 3 in-wc (750 Pa) to 4 in-wc (1000 Pa):
   a. Seal: Class A
   b. Leakage:
      1) Rectangular: Class 3, rate according to Table 1 (Table 2) below.
      2) Round: Class 3, rate according to Table 1 (Table 2) below.

E. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. No variation of duct configuration or size permitted except by written permission and approval from the engineer of record.
3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
9. Exposed single-walled spiral ducts shall use "Sheet Metal Connectors, Inc." seals with E-Z Flange and barrel clamps, sizes 6"-96" diameter. Mastic, caulking and mudding are not approved equals to E-Z Flanges.
    a. Alternative to Sheet Metal Connectors is using "Aeroseal" injected inside ducts to seal entire system.
10. Rectangular ducts with flanges using TDC/TDF corners shall be properly sealed with no gaps.

2.02 METAL DUCTS

A. Material Requirements:
    1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
    2. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.
    3. Stainless Steel: ASTM A666, Type 304 or 316/316L depending on system.

B. Metal Duct Coating Requirements:
    1. Antimicrobial Coating: Factory- or field-applied in accordance with manufacturer's instructions.
    2. Specialty Coatings for Metal Ducts: Field-applied in accordance with manufacturer's instructions.
        a. Application: Sealing.
        b. Description: Stable, non-toxic, non-flammable emulsion of water and vinyl acetate polymer aerosolized into 4-10 micron particles distributed under pressure througout the inside of the duct system.
        c. Performance:
            1) Temperature: -20°F to 480°F
            2) Pressure: up to SMACNA Class 10 in-wg.
            3) VOC: <0.5 mg/cu-m
            4) Resistant to mold and mildew formation
        d. Manufacturers:
            1) Aeroseal, LLC; aeroseal Duct: aeroseal.com.

C. Rectangular Metal Duct:

1. Rectangular Double Wall Insulated: Rectangular spiral lock seam duct with aluminum outer wall, solid aluminum inner wall; fitting with the solid inner wall.
    a. Insulation:
        1) Thickness: As required for R-Value (see 23 07 13)
        2) Material: Fiberglass.
    b. Manufacturers:
        1) Sheet Metal Connectors, Inc.: www.smcduct.com
        2) McGill Airflow, LLC: www.mcgillairflow.com

D. Flat-Oval Metal Ducts:
1. Flat-Oval Single Wall Duct: Machine made from a round spiral lock seam duct.
    a. Fittings: Manufacture at least two gauges heavier metal than the duct.
    b. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

E. Round Metal Ducts:
1. Round Single Wall Duct: Round spirlock seam duct with galvanized steel outer wall.
    a. Manufacturers:
        1) EHG, a DMI Company: www.ehgduct.com
        2) Elgen Manufacturing Company, Inc; Snap Lock Pipes and Fittings: www.elgenmfg.com
        3) Lindab, Inc.: www.lindab.com
        4) Linx Industries, Inc, a DMI Company: www.li-hvac.com
        5) McGill Airflow, LLC: www.mcgillairflow.com
        6) MKT Metal Manufacturing: www.mktduct.com
        7) Nordfab Ducting: www.nordfabductwork.com
        8) SEMCO Incorporated: www.semcohvac.com
        9) Sheet Metal Connectors, Inc.: www.smcduct.com
        10) Spiral Manufacturing Co, Inc.: www.spiralmfg.com
2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
    a. Insulation:
        1) Thickness: As required for R-Value (see 23 07 13)
        2) Material: Fiberglass.
    b. Manufacturers:
        1) Sheet Metal Connectors, Inc.: www.smcduct.com
        2) McGill Airflow, LLC: www.mcgillairflow.com
3. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

F. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Rectangular Duct Construction:
    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 1-4, "Transverse (Girth) 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 1-5, "Longitudinal Seams - Rectangular Ducts," 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. 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 2, "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."

3. Round Duct Construction:
   a. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," 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.
   b. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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) Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.
   c. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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."
4. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   b. VOC Content: Not more than 250 g/L, excluding water.
   c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   d. 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: 3 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.

e. 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 (both PVC coated and bare), stainless steel, or aluminum sheets.

5. Flanged Joint Sealant:
   a. Comply with ASTM C 920.
   b. General: Single-component, acid-curing, silicone, elastomeric.
   c. Type: S.
   d. Grade: NS.
   e. Class: 25.
   f. Use: O.
6. Gasket Tape:
   a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
7. Round Duct Joint O-Ring Seals:
   a. 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.
   b. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

2.03 HANGERS AND SUPPORTS

A. Hanger Rod:
   1. Noncorrosive Environment: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
   2. Corrosive Environemnt: ASTM A36/A36M; steel, electrogalvanized, painted with zinc-chomate primary after installation; threaded both ends, threaded one end, or continuously threaded.

B. Straps/Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Cables:
   1. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
   2. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
   3. 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.

D. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

E. Fasteners:
   1. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:
      a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
c. Beam clamps.
2. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.04 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, mechanically fastened and rolled using galvanized steel to form spiral helix.
1. Insulation: R6 insulation with metalized polyester jacket reinforced with fiberglass scrim.
2. Pressure Rating: 10 in-wc (2.50 kPa) positive, 5 in-wc (1.25 kPa) negative up to 16-inch diameter, and 1 in-wc (0.25 kPa) negative for 18-inch through 20-inch diameter.
3. Maximum Velocity: 4000 fpm (20.3 m/sec).
4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 121 degrees C).
5. Complies with ASTM E84 for flame spread and smoke development.
6. Manufacturers:
a. Flexmaster USA, a brand of Masterduct, Inc; Type 1M: www.flexmasterusa.com.
b. McGill Airflow, LLC; www.mcgillairflow.com.
c. Ward Industries, Inc., a division of Hart & Cooley, Inc.: hcflexduct.com.

2.05 NON-METAL DUCTS

A. Phenolic Ducts:
1. Duct Panel Core: Phenolic Foam Duct
a. Closed cell rigid thermoset phenolic resin material available in R-values up to R-28.
b. Maximum Temperatures: 185°F inside duct or ambient.
c. Maximum Thermal Conductivity: 0.146 Btu-in/hr-sq.ft-°F at 75°F mean temperature.
d. Manufactured with a blowing agent that has zero ozone depletion potential (ODP) and low global warming potential (GWP).
2. Application: Outdoor use.
3. Thermal Resistance: Preinsulated, nonfiborous.
a. R-Value: R-12
4. Static Pressure Construction:
a. Positive: 10 in-wc (2488.4 Pa).
b. Negative: 10 in-wc (2488.4 Pa).
5. Interior Wall:
a. Aluminum.
6. Exterior Cladding:
a. Aluminum: 0.040" Kynar 500 Pre-Finish embossed aluminum.
b. Finish: Mill.
7. Manufacturers:
a. Kingspan Insulation LLC; The Kingspan KoolDuct System: www.kingspaninsulation.us.
b. Thermaduct, LLC; Thermaround Outdoor Ductwork: www.thermaduct.com.

B. Fabric Ducts:
1. Manufacturers:
a. DuctSox Corporation: www.ductsox.com
2. Textile Construction: Filament/filament twill polyester treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518.
a. Textile system to be constructed in modular lengths (zippered).

3. Air Permeability: Dependent on duct material.
    a. The air permeability of the fabric shall not be created by perforating the fabric.
    b. The air permeability must be confirmed be third party testing to eliminate the formation of condensate on the fabric.
4. Performance:
    a. Pressure: 0.25 in-wg to 3 in-wg (62.5 Pa to 750 Pa)
    b. Temperature: 0°F to 180°F (-17.8°C to 82°C)
    c. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
    d. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.
5. Suspension: As indicated on drawings, either by tension cable or U-track, with quantity of cables/tracks determined by duct size.
6. Integrated air dispersion as identified on drawings shall be specified and approved by manufacturer.
7. Options/Fittings: As identified on drawings.
8. Warranty: 10 years.

2.06 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.

B. Minimum Fabrication Requirements:
1. Fabricate acoustic plenum or casing with reinforcing turned inward.
2. Provide 16-gauge, 0.059-inch (1.52 mm) sheet steel back facing and 22-gauge, 0.029-inch (0.76 mm) perforated sheet steel front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers.
3. Construct panels 3 inches (75 mm) thick, packed with 4.5 pcf (72 kg/cu m) minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch (1.52 mm) sheet steel.
4. Mount floor-mounted plenum or casings on 4-inch (100 mm) high concrete curbs. At floor, rivet panels on 8-inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch (1.31 mm) expanded metal mesh supported at 12-inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Access Doors:
1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
3. Provide clear wire glass observation ports, minimum 6 by 6 inch (150 by 150 mm) size.

D. Thermal Panels:
1. Material: Steel-faced composite panel with noncombustible structural high density mineral fiber core for plenum fabrication.
    a. Facing: Galvanized steel (G90), 24 gauge, 0.0275 inch (0.701 mm).
    b. Finish: Unpainted.
    c. Core: Mineral wool board.
    d. Structural: Nonload bearing.
2. R-Value: 12 when tested in accordance with ASTM C177.

E. Fire-Rated Metal Panels:
1. Fire Rating: 60 minutes when tested in accordance with ASTM E119.

2. Material: Steel-faced composite panel with noncombustible structural high density mineral fiber core, UL or ETL labeled, nonload bearing fire separations.
   a. Facing: Galvanized steel (G90), 24 gauge (0.0275 inch) (0.701 mm).
   b. Finish: Unpainted.
   c. Core: Mineral wool board.
   d. Structural: Nonload bearing.

2.07 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm (7.6 to 12.7 m/s).

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:
   1. Duct: 1 in-wc (250 Pa) pressure class aluminum.
   2. Fabricate using single wall, 20-gauge, 0.032-inch type 3003-H14 aluminum sheet.
   3. Seal all joints water tight during installation.

F. Kitchen Hood and Grease Exhaust Duct:
   1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
   2. Zero Clearance, 2-Hour Fire-Rated, Rectangular, Grease Duct:
      a. Listed when tested in accordance with UL 1978 and ASTM E2336.
      b. Construct of 16-gauge, 0.059-inch (1.52 mm) sheet steel using continuous external welded joints in rectangular sections.
      c. Liquidtight with continuous external weld for seams and joints.
      d. Slope at 1/4 inch/foot back to hood for drainage.
      e. Where ducts are not self-draining back to equipment, provide low-point drain pocket with copper drain pipe to sanitary sewer.
      f. Through-penetration firestop listed to UL 1479 or ASTM E814.
      g. Wrap with grease fire wrap to achieve 2-hour fire rating.
   3. Grease Exhaust Duct Access Doors:
      a. Listed when tested in accordance with UL 1978.
      b. Install hinged access doors where indicated or required for access for cleaning and inspection of duct.
      c. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts per Air Diffusion Council installation standards with 2-inch bead collars and draw band with sealant..

G. Install flexible ducts with turn-radius of 1.5x utilizing rigid elbow supports.

H. Flexible ducts shall be limited to 4 feet maximum length and shall be limited to the following locations, unless noted otherwise on drawings:
   1. Supply air ductwork at diffuser, register and grille connections.
   2. Return air ductwork at grille conenctions above accessible ceilings for directly-ducted systems (except where prohibited). Transfers and plenum return systems shall not use flexible ducts.
   3. Flexible duct is not permitted for use for exhaust duct connections to grilles and equipment.

I. Kitchen Range Hoods: Install when provided by food service then fit-out with respective ductwork and accessories to interconnect exhaust system.

J. Kitchen Hood Exhaust: Provide residue traps at the base of vertical risers with provisions for the cleanout.

K. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

L. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

M. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

N. Use double nuts and lock washers on threaded rod supports.

O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

P. Louver Fit-out:
   1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.
   2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.

Q. Fire Partitions: Provide firestopping sealing.

R. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 23 33 00, 23 36 00, and 23 37 00.

S. Duct Insulation: Provide duct insulation. See Section 23 07 13.

T. Painting: Provide surface finish as indicated on drawings.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Duct sealants shall not be silicone based to allow painting of all surfaces.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

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.

F. Install fabric duct suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.
   1. Do not install fabric duct until space post-construction cleaning is complete. If fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

3.03 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. Leakage Test:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Supply ducts on VAV systems greater than 10,000 CFM: Test representative duct sections selected by building owner or designated representative of building owner from sections installed, totaling no less than 25 percent of total installed duct area for each air handler. Air handlers to be tested include RTU/AHU-XX.
      b. Exhaust ducts on locker room ERU systems: Test representative duct sections selected by building owner or designated representative of building owner from sections installed, totaling no less than 25 percent of total installed duct area for each air handler. Air handlers to be tested include ERU-XX.
   3. Leak test each section of duct within a concealed shaft.
   4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   5. Test for leaks before applying external insulation.
   6. Conduct test 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.
   7. Give seven days' advance notice for testing.

C. Maximum Allowable Leakage: Comply with requirements for leakage class 3 for ducts with a duct pressure classification greater than 2-inches, and for leakage class 6 for ducts with duct pressure classification 2-inches or less.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

3.05 FITTING INSTALLATION

A. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
   2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
   3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "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: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
         2) Velocity 1000 to 1500 fpm: 1.0 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. 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: Standing seam.
d. Long Sweep Elbows: Utilize for dryer exhaust, bath fan exhaust and kitchen hood exhaust.

B. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."
a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

3.06 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 DUCT SCHEDULE

A. Aluminum sheet:
1. Pool Equipment Room (RTU-8, EF-6), Supply, Return and Exhaust.
2. Locker Room Exhaust (EF-1,8,10,11)
3. Dryer exhaust: Flanged and gasketed joints or pop riveted joints with no sheet metal screws extending into ductwork.
4. Dishwasher Exhast (EF-4): All seams shall be sealed waterright.
5. All ducts passing through pool, pool equipment and other corrosive environments shall be aluminum sheet.

B. Exterior duct shall be one of the following:
1. One of the listed phenolic ducts:
a. Minimum insulation: R-12
b. Metal exterior cladding: minimum thickness of 0.040” (18 gauge)
2. Double wall with solid non-perforated aluminum inner liner:
a. Minimum insulation: R-12 insulation liner between duct walls.
b. Exterior duct skin shall be aluminum with all joints sealed water tight.

C. Grease duct from kitchen hood to exhaust fan shall be 16 gauge welded class 1 grease duct with (2) 1-1/2" layers of 3M 615+ grease duct wrap for 2 hour shaft rating. Continue firewrap over top of hood as required per local codes. No dampers, turning vanes, or obstructions of any kind shall be in airstream. Contractor shall install code required access panels for cleaning duct at all elbows and where required by code.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning vanes/extractors.

B. Backdraft dampers.

C. Barometric pressure relief dampers.

D. Combination fire and smoke dampers.

E. Duct access doors.

F. Duct test holes.

G. Fire dampers.

H. Flexible duct connectors.

I. Smoke dampers.

J. Volume control dampers.
   1. Manual volume dampers.
   2. Automatic balancing dampers
   3. Remote damper operators.
   4. Iris dampers.

K. Wall Caps

L. Miscellaneous Products:
   1. Fire-rated enclosures.
   2. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.

B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

D. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

H. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

J. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

K. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

M. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide for shop-fabricated assemblies including rated capacities, furnished specialties, and accessories for each type of product. Include electrical characteristics, connection requirements and wiring diagrams.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

D. Project Record Drawings: Record actual locations of access doors and test holes.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Field quality-control test reports.
   4. Wiring Diagrams.
   5. Warranty: Sample of warranty.

PART 2 PRODUCTS

2.01 AIR TURNING VANES/EXTRACTORS

A. Manufacturers:
   1. Tuttle and Bailey; Ductturns

B. Multi-blade device with push on rail and hollow turning vanes with snap-lock eliminating peening and welding; construction matching duct material.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
   1. Greenheck Fan Corporation; EM-Series: www.greenheck.com
   2. Nailor Industries, Inc: www.nailor.com
   3. Pottorff: www.pottorff.com
   4. Ruskin Company: www.ruskin.com.

B. Mounting Orientation: As indicated on the drawings.

C. Construction:
   1. Frame: 0.125 in. extruded aluminum (6063T5) frame with screwed corners.
   2. Blades: Damper blades shall be 0.070 in. extruded aluminum (6063T5).
   3. Blade Edge Seals: Vinyl mechanically fastened to each blade.
   4. Linkage: On blade, plated steel material.
   5. Axles: Aluminum.
   6. Bearings: Synthetic (acetal) sleeve.
   7. Finish: Mill.

D. Performance:
   1. Leakage:
      a. Maximum of 10 cfm at 1" w.g. tested in accordance with AMCA 500-D.
      b. Maximum of 8.9 cfm/sq.ft. at 1" w.g. with a width of height of 24 inch or greater, tested in accordance with AMCA 500-D.
   2. Differential Pressure: Maximum rating of 4" w.g. or 10" w.g. depending on duct system classification.
   3. Velocity: Maximum rating of 3500 fpm (18 m/s).

2.03 BAROMETRIC PRESSURE RELIEF DAMPER

A. Manufacturers:
   1. Greenheck Fan Corporation; BR-Series: www.greenheck.com.
   2. Nailor Industries, Inc: www.nailor.com.
   3. Pottorff: www.pottorff.com.
   4. Ruskin Company: www.ruskin.com.

B. Damper provides pressure relief at differential pressure set points. Blades begin to open in parallel action when start-to-open pressure relief point is reached. Damper continues to open as pressure differential increases. Blades fully open once full-open pressure differential is reached.

C. Mounting Orientation: As indicated on drawings.

D. Construction:
   1. Frame Construction: 16-gauge galvanized steel, extruded aluminum, or stainless steel matching duct material.
   2. Blade: Use aluminum, galvanized steel, or stainless steel matching frame material.
   3. Blade Stops: Each blade stop (at top and bottom of damper frame) shall occupy no more than 3-1/2 in. of the damper opening area to allow for maximum free area and to minimize pressure loss across the damper.
   4. Seals: TPE blade edge, EPDM jamb.
   5. Linkage: External steel tie bars.
   6. Axles: Use galvanized steel or stainless steel.
   7. Bearings: Use stainless steel or synthetic.

E. Differential Pressure Rating Maximum: 2 in-wc (498 Pa). Full-open set point is adjustable.

F. Start-to-Open Pressure: 0.05 in-wc (12.4 Pa). Start-to-open set point is adjustable.

G. Velocity Rating: Rated for 2,000 fpm (10.2 m/sec).

H. Pressure Opening Mechanism: Use blade-mounted counterbalance weight. Adjustable in field.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com.
   2. Greenheck Fan Corporation: wwww.greenheck.com.
   3. Nailor Industries, Inc: www.nailor.com/#
   4. Pottorff: www.pottorff.com.
   5. Ruskin Company: www.ruskin.com.

B. Type: Dynamic, rated and labeled in accordance with NFPA 90A, UL 555, UL 555S by an NRTL.

C. Performance:
   1. Fire Rating:

a. 1-1/2 hours for less than 3-hour assemblies.
b. 3 hours for greater than 3-hour assemblies.
2. Maximum Velocity: 2000 fpm (10.2 m/s).
3. Maximum Pressure: 4" .w.g (1 kPa).
4. Leakage Class I.
5. Maximum Temperature: 250 deg. F (121 deg. C).

D. Provide factory sleeve and collar for each damper.

E. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch (3.2 by 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

F. Operators: UL listed and labeled; spring-return, electric-type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

G. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in 23 05 13 - 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.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).

H. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

I. Smoke detector furnished and wired Division 26.

J. Accessories:
1. Dual auxiliary switches for position indication.
2. Momentary test and reset switches, damper remote mounted.

2.05 DUCT ACCESS DOORS

A. Manufacturers:
1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
3. Greenheck Fan Corporation: www.greenheck.com
4. Nailor Industries, Inc: www.nailor.com.
5. Ruskin Company: www.ruskin.com.
6. SEMCO LLC: www.semcohvac.com.

B. Fabrication in accordance with SMACNA (DCS). Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch (25 mm) thick insulation with sheet metal cover.

C. Door:
   1. Double wall, rectangular.
   2. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   3. Vision panel.
   4. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   5. Fabricate doors airtight and suitable for duct pressure class.

D. Quantity of Hinges and Locks:
   1. Less Than 12 inches (300 mm) Square: No hinges and two sash locks
   2. Up to 18 inches (450 mm) Square: Two hinges and two sash locks..
   3. Up to 24 by 48 inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Four hinges and two compression latches with outside and inside handles..
   5. High Temperature Duct Access Doors:
      a. Comply with NFPA 96.

2.06 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.07 FIRE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com.
   2. Greenheck Fan Corporation: www.greenheck.com.
   3. Nailor Industries, Inc: www.nailor.com/#sle.
   4. Pottorff: www.pottorff.com.
   5. Ruskin Company: www.ruskin.com

B. Type: Dynamic, rated and labeled in accordance with NFPA 90A and UL 555.

C. Performance:
   1. Fire Rating:
      a. 1-1/2 hours for less than 3-hour assemblies.
      b. 3 hours for greater than 3-hour assemblies.
   2. Velocity: 4000 fpm vertical, 2000 fpm horizontal
   3. Maximum Pressure: 4" w.g. (1 kPa)

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations or closure under air flow conditions. Configure with blades out of air stream.

E. Fusible Links: UL 33, separate at 165 degrees F (73.8 degrees C) with adjustable link straps for combination fire/balancing dampers.

F. Frame: Type B, curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

G. Sleeve: Factory installed, galvanized sheet steel.
   1. Minimum Thickness: 0.052 or 0.138-inch-thick, as indicated, and of length to suit application.

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, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

2.08 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
1. Johns-Manville
2. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com.
3. Ductmate Industries, Inc, a DMI Company: www.ductmate.com.
4. Elgen Manufacturing Company, Inc: www.elgenmfg.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. General Indoor Use Flexible Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd (1.0 kg/sq m).
a. Net Fabric Width: Approximately 2 inches (50 mm) wide.
2. Metal: 3 inches (75 mm) wide, 24 gauge, 0.0239 inch (0.61 mm) thick galvanized steel.
3. Coatings and Adhesives: Comply with UL 181, Class I.

2.09 SMOKE DAMPERS

A. Manufacturers:
1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com.
2. Greenheck Fan Corporation: www.greenheck.com.
3. Nailor Industries, Inc: www.nailor.com.
4. Pottorff: www.pottorff.com.
5. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by electric actuator.

D. Operators: UL listed and labeled; spring-return, electric-type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

E. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in 23 05 13 - 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.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).

F. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

G. Smoke detector furnished and wired Division 26.

H. Accessories:
1. Dual auxiliary switches for position indication.
2. Momentary test and reset switches, damper remote mounted.

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers (unless noted otherwise in each subsection):
1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com.
2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com.
3. MKT Metal Manufacturing: www.mktduct.com.
4. Greenheck Fan Corporation: www.greenheck.com
5. Nailor Industries, Inc: www.nailor.com.
6. Pottorff: www.pottorff.com.
7. Ruskin Company: www.ruskin.com.
8. United Enertech: www.unitedenertech.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
1. Material: Same gauge as duct to 24 inches (600 mm) size in either direction, and two gauges heavier for sizes over 24 inches (600 mm).
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers:
1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches (200 by 1825 mm). Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch (1.21 mm), minimum.

F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

H. Automatic Balancing Dampers:

1. General Requirements:
    a. Provide bi-directional, air balancing regulator for pressure independent air volume control.
    b. Complies with UL 2043 for heat and smoke release.
    c. Complies with AMCA 500-D for the allowable leakage rates.
    d. Airflow regulator to be field adjustable.
2. Construction:
    a. Frame: Thermoplastic resin in compliance with UL 94.
    b. Blade: Thermoplastic resin in compliance with UL 94.
    c. Bearings: Hydraulic blade dampener.
    d. Outer Seal: Removable rubber gasket-type around circumference of damper.
    e. Spring: Stainless steel leaf-type.
    f. Temperature Range: 25 to 150 degrees F (Minus 4 to 65 degrees C) .
    g. Operating Range: 0.2 to 2 in-wc (50 to 498 Pa).
    h. Airflow Range: 25 cfm to 450 cfm across sizes 4" to 8".
3. Accessories:
    a. Provide with rectangular to round transitions where fully ducted.
    b. Include access hatch in duct for access to adjustment for balancing.
4. Manufacturers:
    a. Automatic Airflow Balancing, a brand of Metal Industries Inc: www.airflowbalancing.com.
    b. Greenheck Fan Corporation; ABD (basis of design): www.greenheck.com
    c. Ruskin Company: www.ruskin.com.
    d. United Enertech: www.unitedenertech.com.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

I. Remote Damper Operators:
1. Description: Manual, worm-gear driven, cable actuated volume damper controller with ceiling operator. Damper operator mounts to damper shaft secured to duct.
2. Mounting: Universal accommodating damper shaft sizes from 1/4" to 3/8" square, or 1/4" to 1/2" round.
3. Cable: 1/4" plated steel rotary cable.
4. Ceiling Operator: Metal mounting bracket securing the 1/4" diameter brass plated steel rotary cable in a ceiling opening. Cable driven by 1/4" hex nut driver.
    a. Include nylon cap to seal the ceiling access hole.
5. Manufacturers:
    a. Greenheck Fan Corporation: www.greenheck.com
    b. Metropolitan Air Technologies; RT-WGA with RT-CCM (basis of design): metair
    c. Young Regulator Company: youngregulator.com.

J. Iris Dampers:
1. Description: Manually adjusted damper comprising of blades providing circular free area at the center of the damper, integral pressure ports, and adjustment knob.
2. Construction:
    a. Material: 22 ga. galvanized steel or 316 stainless steel depending on duct material.
    b. Connections: Beaded and EPDM gasketed.
    c. Pressure taps across damper for precise airflow measurement with manufacturer's tables/charts.
3. Performance:
    a. Controllability: +/- 5 percent of design flow.

b. Leakage: Not exceed 6 cfm.

4. Manufacturers:
   a. Continental Fan; IRIS-Series (basis of design): continentalfan.com.
   b. Ruskin Company: www.ruskin.com.
   c. United Enertech: www.unitedenertech.com.
   d. Substitutions: See Section 01 6000-Product Requirements.

2.11 WALL CAPS

A. Hooded Wall Caps:
   1. Manufacturers:
      a. Air King.
      b. Broan.
      c. Famco.
      d. NuTone.
      e. Vent-A-Hood.
   2. Material: Galvanized metal prepared for field painting in accordance with ASTM D6386.
   3. Mounting: 1-1/4” attachment collar
   4. Accessories:
      a. Backdraft damper.
      b. Bird screen (non-dryer applications)

B. Louvered Wall Caps:
   1. Manufacturers:
      a. XVentBox: www.xventbox.com
   2. Construction:
      a. Material: Thermal plastic in compliance with ASTM E84, UL 723, and UL 94.
      b. Monolithic box cavity.
      c. Removable front louver.
      d. Duct Connections: As indicated on drawings for sizes and quantities.
   3. Installation style to match wall construction.
   4. Accessories:
      a. Backdraft dampers.

2.12 MISCELLANEOUS PRODUCTS

A. Fire-Rated Enclosures:
   1. Provide as required to preserve fire resistance rating of building elements.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils (0.6 mm).
   2. High tack water based adhesive.
   3. UV stable light blue color.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.

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. Provide backdraft dampers or motorized dampers on exhaust fans or exhaust ducts nearest to outside where indicated on drawings.

D. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, at louver plenums, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 by 8 inch (200 by 200 mm) size access door for hand and shoulder access, or as indicated on drawings. Review locations prior to fabrication.

E. Provide duct test holes where required for testing and balancing purposes.

F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

G. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

H. Demonstrate re-setting of fire dampers to Owner's representative.

I. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

J. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

K. Connect terminal units to supply ducts directly. Do not use flexible ducts to change directions.

L. Connect diffusers to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.

M. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

N. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off. 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.

O. Set dampers to fully open position before testing, adjusting, and balancing.

P. Use splitter dampers only where indicated.

Q. Provide balancing dampers on high velocity systems where indicated.

R. Seal open ends of all supply, return, exhaust, outdoor air, combustion air, vents, etc. and equipment connections with UV resistant blue adhesive film at all times, including stored items and installed items.

3.02 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 and fire/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.

6. Mark manual volume dampers with 12" long red tape prior to balancing for easy identification.

END OF SECTION

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SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Powered roof ventilators.

C. Ceiling exhaust fans.

D. Inline centrifugal fans and blowers.

E. Kitchen Type I hood roof exhausters.

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

C. Section 23 31 00 - HVAC Ducts and Casings.

D. Section 23 33 00 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2025.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

J. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates

3. Wiring diagrams
4. Warranty: Sample of warranty.
5. Field quality-control test reports.

1.06 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. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Enclosed Safety Switches: Comply with NEMA EN 10250.

H. Kitchen Type I Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762 (UL 705 - supplement SC - restaurant exhaust).

2.02 POWERED ROOF VENTILATORS

A. Manufacturers:
   1. Greenheck Fan Corporation: www.greenheck.com.
   2. Plastec

B. Fan Unit: V-belt or direct driven as indicated on drawings, with removable spun aluminum housing; resilient mounted motor; aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: 24 inch (600 mm) high self-flashing of galvanized steel with continuously welded seams, insulation and curb bottom, hinged curb adapter, and factory installed nailer strip.

D. Fan Wheels
   1. Greenheck: Aluminum hub and wheel with backward-inclined blades.
   2. Plastec: Forward-curved type and constructed of uniformly molded polypropylene blades. Wheel shall be both electronically and dynamically balanced. Fan wheel shall be supplied with a motor shaft bushing and hubcap made of polypropylene to protect shaft end.

E. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor.

F. Damper: As indicated on drawings.

G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

H. Options/Accessories:

1. Hinge Kit:
    a. Hinges and restraint cables mounted to base sleeve.

I. Performance Ratings: As indicated on drawings.

2.03 CEILING EXHAUST FANS

A. Manufacturers:
1. Greenheck

B. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Electrical Requirements:
1. Junction box for electrical connection on housing and receptacle for motor plug-in.
2. Disconnect Switch: Plug-style for thermal overload protected motor.

E. Grille: Aluminum with baked white enamel finish.

F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

G. Performance Ratings: As indicated on drawings.

H. Accessories:
1. Companion Flanges: For outlet duct connection.
2. Wall cap, as indicated on drawings.

2.04 INLINE CENTRIFUGAL FANS AND BLOWERS

A. Manufacturers:
1. Greenheck
2. Plastec

B. Description:
1. Greenheck: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
2. Plastec: In-line, direct-driven corrosive air application centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing:
1. Greenheck: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
2. Plastec: Constructed of strong high-density UV treated polypropylene for corrosion resistance. Housing shall be made of on single piece to completely avoid leaks. Split molded housing is not allowed.

D. Fan Wheels:
1. Greenheck: Aluminum, airfoil blades welded to aluminum hub.
2. Plastec: Forward-curved type and constructed of uniformly molded polypropylene blades. Wheel shall be both electronically and dynamically balanced. Fan wheel shall be supplied with a motor shaft bushing and hubcap made of polypropylene to protect shaft end.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

F. Performance Ratings: As indicated on drawings.

G. Accessories: As indicated on drawings.

2.05 KITCHEN TYPE I HOOD ROOF EXHAUSTERS

A. Manufacturers:
   1. Greenheck

B. Direct- and Belt- Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced.
   2. Housing:
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

D. Drive Assembly:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. Motor pulley adjustable for final system balancing.
   5. Readily accessible for maintenance.

E. Disconnect Switches:
   1. Factory mounted and wired.
   2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Outdoor Locations: Type 3R.
   3. Finish for Painted Steel Enclosures: Provide factory-applied gray unless otherwise indicated.
   4. Positive electrical shutoff.
   5. Wired from fan motor to junction box installed within motor compartment.

F. Roof Curb: 24 inch (600 mm) high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip. Fan discharge shall be minimum 40" from any roof surface, adjust curb height as necessary.

G. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

H. Options/Accessories:
   1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
   2. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
   3. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
   4. Grease Trap:
      a. Container system to collect grease residue.
   5. Hinge Kit:
      a. Hinges and restraint cables mounted to base sleeve.
   6. Heat Baffle: Prevents heat from radiating into motor compartment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads, see Section 23 05 48.
   2. Suspend units from structure; use steel wire or metal straps.

E. Provide sheaves required for final air balance.

F. Install backdraft or motorized dampers on inlet to roof and wall exhausters, as indicated on drawings.

G. Install units with clearances for service and maintenance.

H. Label units according to requirements specified in 23 05 53 - Identification for HVAC Piping and Equipment.

3.02 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 23 33 00 - Air Duct Accessories.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26.

D. Connect wiring according to Division 26.

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in 23 05 93 - 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 where required.

END OF SECTION

SECTION 23 35 01
DRYER-VENT EXHAUST COLLECTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laundry exhaust systems.

B. Accessories.
   1. Central lint collectors.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; 2025.

B. ANSI Z223.1 - National Fuel Gas Code; 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; 2024.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

F. UL 378 - Standard for Draft Equipment; Current Edition, Including All Revisions.

G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data indicating system components such as clothes dryer boosters, supply fans, dampers, controls, and factory-built chimneys. Also include dimensional details of components and flue caps, dimensions, weights, electrical characteristics, and connection requirements.

B. Shop Drawings: Indicate general construction, dimensions, weights, support, and layout of breechings and ductwork. Submit layout drawings indicating plan view and elevations where factory-built units are used.

C. Manufacturer's Instructions: Include installation instructions and indicate assembly, support details, and connection requirements.

1.05 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture and shall be of a standard catalog product.

B. Mechanical Venting System guaranteed to operate satisfactory and efficiently without objectionable exhaust or odor.

C. Scheduled equipment performance is minimum capacity required.

D. Scheduled electrical capacity shall be considered as maximum available.

E. Equipment to be manufactured at ISO 9001 certified plant.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Regulatory Requirements:

1. Comply with ANSI Z223.1.
2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 LAUNDRY EXHAUST SYSTEMS

A. Manufacturers:
   1. ENERVEX, Inc.: enervex.com.

B. Fabrication: Direct-drive, backward-curved fan enclosed in galvanized steel housing.

C. Comply with AMCA 99, UL 378, and UL 705.

D. Maximum Fan Temperature Rating: 575 degrees F (300 degrees C) of exhaust gas.

E. Accessories:
   1. Pressure controller.
      a. Modulating fan control maintaining constant duct pressure between 0.0-in.w.g. and 0.6-in-w.g. with tolerance of 0.01-in-w.g.
      b. Potentiometer to set the required duct pressure and a LCD-panel to display the value. The LCD-panel must also be able to show the actual duct pressure.
      c. Electrical terminals monitored constantly via LED-diodes for verification of proper operation.
      d. LED-diodes to verify ventilator operation and cycling.
      e. LED-diode to indicate alarm.
      f. Safety function to shut down dryer in case of insufficient duct pressure or ventilator failure and indicate this with a visual alarm.
   2. Current sensing relay.

F. Electrical Characteristics: As indicated on drawings.
   1. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.03 ACCESSORIES

A. Central Lint Collector:
   1. Construction: Fiberglass housing with removable reinforced vinyl holding bag; wall, floor or ceiling mount; supplied with mounting brackets/legs.
   2. Products:
      a. Clean Cycle Solutions; "Small Wonder" OPL-200/300 Series: www.cleancyclesystems.com

B. Support plates and rings.

C. Cleanout access at shaft base.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install dryer vent stacks, breechings, and ductwork with minimum of joints. Align accurately at connections with smooth internal surfaces.

C. Rigidly support shafts, stacks, and ductwork from building structure with suitable ties, braces, hangers, and anchors to hold shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot (4 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

D. Coordinate installation of dampers and induced draft fans; see Section 26 05 83.

E. Maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

F. Assemble and install stack sections in accordance with NFPA 82, industry practices, and complying with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

G. Level and plumb stacks.

H. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

I. At appliances, provide slip joints permitting removal of appliances without removing or dismantling breechings, breeching insulation, chimneys, or stacks.

3.02 OPERATING TESTS, START-UP AND ON-SITE SERVICES

A. System vendor’s service organization shall employ senior service technicians having experience in all aspects of troubleshooting, corrective service and preventative maintenance and O&M reporting.

B. After installation is completed test the operation of the Mechanical Dryer Venting System.

END OF SECTION

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Shutoff, single-duct air terminal units.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Wiring Diagrams
   3. Source quality-control reports
   4. Field quality-control reports.

1.04 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: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 PRODUCTS

2.01 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Price Industries Model #SDV
   2. Titus Model #DESV
   3. Nailor 3000 Series

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall, fiber free foam.
   1. Casing Lining: Adhesive attached, 3/4-inch thick, coated, fiber free polymer foam duct liner complying with ASTM C 665, 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. Liner – Fiber free polymer foam with sealed edges, model no. FF.
   2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections.
   4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
   2. Damper Position: Normally open or last position.

E. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
   1. Control: Proportional SCR controller.
   2. Access door interlocked disconnect switch.
   3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
   4. Nickel chrome 80/20 heating elements.
   5. Airflow switch for proof of airflow.
   6. Fuses in terminal box for overcurrent protection (for coils more than 48 A).

F. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
   1. Damper Actuator: 24 V, powered closed, spring return open or retain last position.
   2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
      a. Occupied and unoccupied operating mode.
      b. Remote reset of airflow or temperature set points.
      c. Adjusting and monitoring with portable terminal.
      d. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."
   3. Room Sensor: Wall mounted, with temperature set-point adjustment and access for connection of portable operator terminal.
      a. Mother's, Infants, and other rooms as shown on plan - adjustable sensor with LCD display and temperature set-point adjustment.
      b. All other spaces - non-adjustable sensor without display.

2.02 HANGERS AND SUPPORTS

A. Hanger Rods: Cadmium-plated steel rods and nuts.

B. Steel Cables: Galvanized steel complying with ASTM A 603.

C. 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.

D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.03 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

3.01 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.

3.02 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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.

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.

3.03 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.04 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. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
   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.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   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.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS, GRILLES AND LOUVERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Diffusers.
   2. Registers.
   3. Grilles.
   4. Louvers.

B. Related Sections:
   1. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.02 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.
   3. For louvers and accessories: Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   4. Color chart.

PART 2 PRODUCTS

2.01 DIFFUSERS, REGISTERS AND GRILLES

A. Diffuser, Registers and Grilles:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Price Industries.
      b. Krueger.
      c. Titus.

B. Adjustable square ceiling diffusers shall be Price Industries of sizes indicated on the drawings and types as specified in the schedule or notes on the drawings.

C. Exhaust registers in the locker rooms shall be aluminum to prevent corrosion.

D. Exhaust registers and all components in the pool area shall be stainless steel to prevent corrosion.

E. Accessories:
   1. Return Air Canopy:
      a. Manufacturer:
         1) Price Industries; RAC
      b. Description: Lightweight canopy of sound absorbing materials positioned directly above a return grille preventing the transfer of occupant noise into the plenum, and preventing plenum noise from flanking through the grille.
      c. General Requirements:
         1) Airstream surfaces installed in return air plenum to comply with requirements in ASHRAE Std 62.1.

d. Materials:
   1) 24-gauge solid steel casing.
   2) Fiber-free foam liner per UL 181 and ASTM C1071.
e. Locations:
   1) Where indic

2.02 LOUVERS

A. Louvers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Greenheck.
      b. Pottorff.
      c. Louvers & Dampers, Inc.

B. Construction:
   1. Channel Frame: 0.81-inch (20.5-mm) extruded aluminum.
   2. Blades: 4-inch (100-mm) deep.
   3. Screen: 1/2-inch (12.7-mm) mesh.
   4. Sill extension: 4-inch (100-mm) where required.
   5. Finish: To be verified by Architect prior to ordering.

2.03 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

3.01 DIFFUSERS, REGISTERS AND GRILLES INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

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.

3.02 LOUVER 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 weather tight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-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.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

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SECTION 23 51 00
BREECHINGS, CHIMNEYS AND STACKS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Listed double-wall vents.
   2. Positive pressure vents

1.02 SUBMITTALS

A. Product Data: For the following:
   1. Special gas vents.
   2. Positive pressure vents

B. Warranties: Special warranties specified in this Section.

C. 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.

D. Warranty: Special warranty specified in this Section.

1.03 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.

1.04 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.

B. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 LISTED SPECIAL GAS VENT

A. Available Manufacturers:
   1. Heat-Fab Inc.
   2. Jeremias

B. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F (537 deg C) continuously, 1400 deg F intermittent, with positive or negative flue pressure complying with NFPA 211 and suitable for condensing-gas appliances.

C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch (13-mm) airspace.

D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

E. Outer Jacket: 430 stainless 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: Round chimney top designed to exclude 98 percent of rainfall.

2.02 POSITIVE PRESSURE VENTS

A. The vent shall be of the single wall, factory-built type, designed for use in conjunction with Category II, or IV condensing gas fired appliances, condensing oil fired appliances or as specified by the heating equipment manufacturer.

B. All products furnished under this Section shall conform to the requirements of The National Fuel Gas Code, ANSI Z223.1/NFPA-54 where applicable and shall comply with and be listed to UL-1738, the US Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV and ULC-S636-95, the Canadian Standard for Type BH gas vent systems. These requirements cover venting systems intended for venting Category II or IV gas-burning appliances as defined by the Standard for Gas-Fired Central Furnaces (except Direct-Vent Central Furnaces), ANSI Z21.47 and the National Fuel Gas Code, NFPA 54. Venting systems covered by these requirements are intended to be used with Category II, III, and IV appliances that have been installed in accordance with NFPA 54, and with codes such as the BOCA National Mechanical Code, the Standard Mechanical Code, the Uniform Mechanical Code, and local codes. Components coming in direct contact with products of combustion shall carry the appropriate UL/cUL labels
   1. Available Manufacturers:
   2. InnoFlue by Centrotherm

C. Maximum continuous flue gas temperature shall not exceed 230 degrees F (110 degrees C).

D. Vent shall be listed for a maximum positive pressure rating of 20” w.c.

E. The vent system shall be continuous from the appliance’s flue outlet to the vent termination outside the building. All systems components shall be UL/cUL listed and supplied by the same manufacturer.

F. The vent shall be constructed from Flame Resistant Polypropylene, with a min. wall thickness of:

Diameter		Wall thickness extruded pipes			
Diameter (mm)	diameter (inch)	min (mm)	max (mm)	min (inch)	max (inch)
DN 60	2"	1.7	2.2	0.0669	0.0866
DN 80	3"	1.8	2.4	0.0709	0.0945
DN 110	4"	2.4	3.2	0.0945	0.1260
DN 125	5"	2.7	3.7	0.1063	0.1457
DN 160	6"	2.9	4.5	0.1142	0.1772
DN 200	8"	3.5	4.5	0.1378	0.1772
DN 250	10"	3.3	4.7	0.1299	0.1850
DN 315	12"	4.2	5.8	0.1654	0.2283

G. All systems components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings required to install the vent system shall be UL/cUL listed and provided by the vent manufacturer.

H. All systems components shall include a factory- installed gasket in their female-end to render the vent air and watertight when the male/female ends are pushed together as per manufacturer's instructions. Vent systems requiring field installed sealants or compounds shall not be acceptable.

I. Vent layout shall be designed and installed in compliance with manufacturer's installation instructions and all applicable local codes.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. The height of flue shall be a minimum of 6' above the roof level on which it is located.

B. Seal between sections of positive-pressure vents 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. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.

F. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.

G. Erect stacks plumb to finished tolerance of no more than 1 inch (25 mm) out of plumb from top to bottom.

H. The vent system must conform with all manufacturer's recommendations and shall utilize UL listed stainless steel AL-29-4C Positive Pressure. The vent must be sized in accordance with the boiler manufacturer's recommendations.

3.03 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

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SECTION 23 52 16
CONDENSING BOILERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.02 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.03 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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.04 WARRANTY

A. Warranty: The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components and accessories against defects in workmanship and material for a period of 18 months from date of shipment or 12 months from date of installation, whichever comes first. Heat exchanger shall be warranted for a period of ten (10) years non-prorated from date of shipment.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Wiring Diagrams
   4. Source quality-control reports
   5. Warranty: Sample of special warranty

PART 2 PRODUCTS

2.01 BOILER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. RIELLO: Model# AR

B. Description:
   1. Each boiler shall be completed with all components and accessories necessary for a complete and operable boiler as hereinafter specified. Each boiler shall be assembled with required wiring and piping as a self-contained unit.

2. The boiler shall be gas fired floor standing condensing boiler with multiple stainless steel(AISI 316L) watertube heat exchangers for redundancy. Each 500 MBH module is fully independent and “stand alone” thus allowing boiler operation even if an adjacent module is turned off.
3. The boiler shall be designed for a minimum of 20:1 turn down on AR2000 with constant CO2 over the turn down range.
4. The boiler will use a direct ignition system. The design shall provide quite burner ignition and operation. The burner shall be pre-mix radial type and fire in 360 degrees vertical pattern.

C. Performance:
1. The boiler shall be ETL certified as a condensing boiler. The boiler shall operate with natural gas or propane and have an ETL certified input rating as noted on the drawings, and shall be listed with AHRI and shall have a minimum thermal efficiency rating of 96.1% at rated input..
2. The boiler shall be designed for a minimum of 20:1 turn down on AR2000 with constant CO2 over the turn down range.

D. Heat exchanger construction:
1. The water tube (AISI 316L) stainless steel heat exchangers shall be inspected and tested to ASME Section IV requirements and shall bear the ASME section IV seal of approval..
2. The heat exchangers shall have welded construction (no gaskets) consisting of two pipes working in parallel. Each pipe shall have three welded joints. The heat exchanger shall be a fully condensing cylindrical counter-flow water tube design with AISI stainless steel tubes and headers.
3. Each 500 MBH module shall be fully independent and “stand alone” with maximum working pressure of 80 psig (550 kPa).
4. The individual modules shall be removable from the boiler while the remainder of the modules, on other rows, within the boiler remain firing. The removal and replacement of such heat exchanger shall not require welding or hoisting equipment.
5. The boiler shall be capable of operating with a minimum outlet water temperature of 68 ºF.
6. Each heat exchanger shall be accessible for visual inspection and cleaning of all internal fire side surfaces.
7. The boiler shall be equipped with an ASME certified pressure relief valve on each row; for models AR each heat exchanger shall be furnished with one pressure relief valve.
8. Each heat exchanger shall be equipped with a dedicated water pump, flow meter, condensate trap and drain valve.
9. The heating surface of each module shall be 43 SQ.FT/ 500,000BTU.

E. Burner:
1. The burner shall be a premix burner with a stainless steel knitted metal fiber construction.
2. The burner shall not produce more than 0.04% of Carbon monoxide (CO) at all firing rates.
3. The burner shall be certified for Oxides of Nitrogen (NOx) of 9 ppm corrected to 3% oxygen.
4. Air/Gas ratio control gas valve shall operate on the principle of negative pressure and modulate to maintain combustion characteristics across the full operating range, which shall provide safe operation even in the case of blocked air intake.

F. Controls:
1. The boiler shall have a touchscreen display located outside the front panel and a service screen located inside the front panel.

2. The outer display shall have a 7” color touchscreen and shall provide full diagnostics including real time data logging.
3. The control shall display the amount of water flow going through each module.
4. The control shall be capable of lead/lag sequencing up to eight 8 boilers in “Cascade”.
5. The control must display any error codes whether automatically reset or manually reset.
6. The boiler shall be provided as a standard with ModBus RS485 communication capabilities.
7. Optional protocol converter for ModBus Lonworks, N2, BacNet MS/TP or BacNet IP shall be available as an optional accessory.
8. The boiler control system shall be capable of accepting 0-10VDC remote external analog signal to control the temperature set point.
9. The control system shall be capable of resetting the set point based on outdoor air temperature with the optional outside air temperature sensor (field installed).
10. The control shall monitor flue gas temperature and stop the boiler if the temperature is excessive.
11. The boiler safety control shall be furnished with controls for low gas pressure and high gas pressure, water pressure and low water cut off. Each module within the boiler shall be furnished with the following safety control devices which if in alarm shall not affect the normal operation of other modules within the boiler, blocked flue, blocked condensate, water temperature high limit, stack limit, water flow meter and temperature rise limiter.
12. The control shall graphically show the firing rate of each module in the boiler and each boiler in the cascade.
13. The boiler control software shall have the capability to be upgraded via USB stick.
14. The control shall be capable of switching its mode to operate from an internal setpoint if its external control signal is lost.
15. The boiler shall display service reminder notifications.

G. Casing: The frame shall be made of extruded aluminum alloy (EN AW-6060) and finished with a baked enamel powder coat (RAL7016). The panels shall be made of 18 and 22 gauge carbon steel and finished with a baked enamel powder coat (RAL9006).

H. Characteristics and Capacities:
1. Heating Medium: Hot water.
2. Energy Input: 100 – 2,000 MBh (586 kW).
3. Heating Output: 1,921 MBh (540 kW).
4. Gas Inlet Pressure: 6.5” W.C (13.8 kPa).

I. Electrical Characteristics:
1. See drawings for model selection.

2.02 TRIM

A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."

B. Safety Relief Valve: ASME rated.

C. Boiler Air Vent: Automatic.

D. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.

E. Remote Contacts:
1. Accepts enable / disable signal from BAS.
2. Accepts 0-10vDC signal from BAS for temperature setpoint.
3. Contacts for Boiler Fault.
4. Boiler shall be supplied with a gateway for communicating with BAS via Modbus, BacNet, N2.

2.03 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.04 VENTING

A. HVAC Contractor shall furnish and install venting, complete UL approved double wall positive pressure venting system, ASTM A 959, Type AL29-4C stainless steel double wall pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
   1. Innoflue by Centrotherm shall be an approved alternate to AL29-4C venting.

B. Combustion-Air Intake: Complete system, pipe, vent terminal with screen, inlet air coupling, and sealant. Inlet screen to be no less than 1” mesh.

C. Boiler Venting Guideline must be followed.

D. Installing contractor must develop and detailed and fully dimensioned sketch of each boiler venting route from outlet of boiler to final termination. Once the installation drawing is approved by the installing contractor, venting will be ordered.

2.05 SOURCE QUALITY CONTROL

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.01 BOILER INSTALLATION

A. Installation shall be performed by the contractor in accordance with the requirements of the applicable codes and manufacturer’s instructions. Contractor shall review the boiler and installation for compliance with requirements and/or issues that may affect boiler performance. Installation should not proceed until unsatisfactory conditions have been corrected.

B. Install boilers level on concrete base at a height above the floor as required by boiler manufacturer’s recommendation for proper condensate drainage and boiler operation. Concrete base is specified in Division 23 Section “Common Work Results for HVAC”, and concrete materials and installation requirements are specified in Division 03.

C. Vibration Isolation: Elastomeric isolation pads with a minimum static deflection of 0.25 inch.

D. Install gas-fired boilers according to NFPA 54 and ANSI Z223.1.

E. Assemble and install boiler trim.

F. Install electrical devices furnished with boiler but not specified to be factory mounted.

G. Install control wiring to field-mounted electrical devices.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping above boiler to allow required clearances for service and maintenance.

C. Check manufacturer’s installation manual for clearance dimensions and install piping adjacent to boiler to allow service and maintenance.

D. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

E. Install piping from condensate drain connection to nearest floor drain. Piping shall be at least full size of connection and adhere to proper codes for neutralization. Provide an isolation valve if required. Use PVC, CPVC, stainless steel, aluminum or polypropylene for condensate drain piping. DO NOT use carbon or copper components.

F. Install piping from safety relief valve common piping at bottom of boiler to nearest floor drain.

G. Connect gas piping to boiler gas train inlet with unions. Piping shall be at least full size of gas train connection. Provide gas pressure regulator if necessary.

H. Flush & clean boiler upon completion of installation in accordance with manufacturer’s instructions. Boiler must be isolated when any cleaning or testing of the system piping is being performed.

I. Boiler Venting
   1. Install flue venting and combustion-air intake according to manufacturers recommendations.

J. Install electrical devices furnished with boiler but not specified to be factory mounted.

K. Install control wiring to field-mounted electrical devices.

L. Ground equipment according to Division 26 Section "Grounding and Bonding."

M. Connect wiring according to Division 26 Section "Conductors and Cables."

3.03 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 installation and startup checks according to manufacturer's written instructions.
   2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
   3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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SECTION 23 57 00
HYDRONIC HEAT EXCHANGERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes plate and frame heat exchangers.

1.02 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.03 QUALITY ASSURANCE

A. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

PART 2 PRODUCTS

2.01 GASKETED - SINGLE WALL PLATE HEAT EXCHANGERS

A. Manufacturers:
   1. Taco

B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. Frame:
   1. Capacity to accommodate 20 percent additional plates
   2. Painted carbon steel with provisions for anchoring to support.

E. Top and Bottom Carrying and Guide Bars: Painted stainless steel.
   1. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger carrying and guide bars are anchored to building structure.

F. End-Plate Material: Painted stainless steel.

G. Tie Rods and Nuts: Steel or stainless steel.

H. Plate Materials: 0.024 inch thick before stamping; Titanium.

I. Gasket Materials: Nitrile rubber.

J. Piping Connections:
   1. NPS 2 and smaller: Threaded ends according to ASME B1.20.1.
   2. NPS 2-1/2 and larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges

K. Enclose plates in solid aluminum removable shroud.

PART 3 EXECUTION

3.01 HEAT-EXCHANGER INSTALLATION

A. The Boiler Contractor shall furnish and install the pool heat exchangers per the manufacturers recommendations and according to details on plan. The Pool Contractor will make connections on the pool water side of heat exchanger.

3.02 CONNECTIONS

A. Install shutoff valves at heat-exchanger inlet and outlet connections.

B. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

C. Install hose end valve to drain shell.

D. Pool Contractor will make connections on the pool water side of the heat exchanger.

E. Pool Contractor to provide and install 12 inch long stainless steel piping from the connection to the heat exchanger before switching to schedule 80 PVC piping. Pool Contractor must also remove any brass plugs from heat exchanger and install a stainless steel plug.

END OF SECTION

SECTION 23 74 16
PACKAGED, OUTDOOR, AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes packaged rooftop units and make-up air units with the following components and accessories:
   1. Direct-expansion cooling.
   2. Gas furnace.
   3. Economizer outdoor- and return-air damper section.
   4. Integral, space temperature controls.
   5. Roof curbs.

1.02 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. ARI Compliance:
   1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
   2. Comply with ARI 270 for testing and rating sound performance for RTUs.

C. UL Compliance: Comply with UL 1995.

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. ASHRAE Compliance:
   1. Comply with ASHRAE 15 for refrigerant system safety.
   2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
   3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.04 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.05 WARRANTY

A. General Warranty: The manufacturer shall submit a written warranty agreeing to repair or replace components that fail in materials or workmanship within the specified warranty period.
   1. Provide manufacturer's parts warranty on the entire unit and all components contained within for one (1) year. The warranty period shall begin at substantial completion.

B. Special Warranty: The manufacturer shall submit a written warranty agreeing to repair or replace components that fail in materials or workmanship within the specified warranty period.
   1. Compressors: Five (5) years non-prorated warranty shall be provided for the compressors. The warranty period shall begin at substantial completion.
   2. Gas Furnace: Ten (10) years non-prorated warranty shall be provided for all gas furnace heat exchangers. The warranty period shall begin at substantial completion.
   3. Solid-State Ignition Modules: Three (3) years non-prorated warranty shall be provided for all solid-state ignition modules. The warranty period shall begin at substantial completion.
   4. Control Boards: Three (3) years non-prorated warranty shall be provided for all unit control boards. The warranty period shall begin at substantial completion.
   5. Variable Frequency Drives: Five (5) years non-prorated warranty shall be provided all variable frequency drives. The warranty period shall begin at substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements called for in the schedules located on the plans.
   1. Single Zone: Lennox Industries
   2. Variable Air Volume: Daikin Applied

2.02 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
   1. Exterior Casing Thickness: 0.0626 inch (1.6 mm) thick.

C. Inner Casing Fabrication Requirements:
   1. Inside Casing: Galvanized steel, 0.028 inch (0.7 mm) thick, perforated 40 percent free area.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   1. Materials: ASTM C 1071, Type I.
   2. Thickness: 1 inch (25 mm).
   3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
   4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of galvanized-steel sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1-2004.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstreams Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
1. Pan-Top Surface Coating: Corrosion-resistant compound.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.03 FANS

A. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

C. Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.

D. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in 23 Section "Seismic Controls For HVAC" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

E. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For HVAC."

2.04 COILS

A. Supply-Air Refrigerant Coil:
1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1-2007.
4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1-2004.

B. Outdoor-Air Refrigerant Coil:
1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.

C. Hot-Gas Reheat Refrigerant Coil:
1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all coper coil from contacting steel coil frame or condensate pan.

2.05 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Refer to Schedule.

B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. Refrigeration Specialties:

1. Refrigerant: R-454B
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.

2.06 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   1. Pleated: Minimum 90 percent arrestance, and MERV 13.

2.07 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
   1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.
   1. Fuel: Natural gas.
   2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
   3. High-Altitude Model for Project elevations more than 2000 feet (610 m) above sea level.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Safety Controls:
   1. Gas Control Valve: Modulating.
   2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.08 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   1. Damper Motor: Modulating with adjustable minimum position.
   2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1-2004, with bird screen and hood.

2.09 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Manufacturer shall provide a programmable digital control system for each unit. A user terminal with digital display shall provide capability of monitoring operation and changing setpoints through an integral keypad. The user terminal shall be unit mounted. The manufacturer shall program the sequence of operation as specified in this section.

1. All unit controls shall be hardwired, wireless controls are not permitted.
2. Basic Unit Controls:
    a. Wall-Mounted combination thermostat/humidistat sensor with the following features:
    b. Heat-cool-off switch.
    c. Fan on-auto switch.
    d. Fan-speed switch.
    e. Automatic changeover.
    f. Adjustable deadband.
    g. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply air temperature, operating mode, and status.

B. The unit mounted controller shall communicate with the Building Automation System through factory provided BACnet interface. The BACnet interface shall include a interface relay for scheduled operation. The BACnet interface shall have the following features:
1. Adjusting set points.
2. Monitoring supply fan start, stop and operation.
3. Inquiring data to include outdoor-air damper position, supply and room air temperature.
4. Monitoring occupied and unoccupied operations.

C. Additional Monitoring:
1. Constant and variable motor loads.
2. Variable frequency drive operation.
3. Economizer cycle.
4. Cooling load.
5. Air distribution static pressure and ventilation air volumes (VAV units).

D. Alarm Indication: The BACnet interface shall include an interface relay to provide indication of fault and store diagnostic code information to the BAS.

E. Provide return air mounted Carbon Dioxide (CO2) detector as noted in schedule to control outdoor air damper.

F. Provide dehumidification control on units as noted in schedule on plan.

G. Provide discharge air sensor and pressure transducer for VAV operation as noted on plan and in schedules.

2.11 ACCESSORIES

A. Electric heater with integral thermostat maintains minimum 50 deg F (10 deg C) temperature in gas burner compartment.

B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Hail guards of galvanized steel, painted to match casing.

2.12 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    a. Materials: ASTM C 1071, Type I or II.

b. Thickness: 2 inches (50 mm).

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
   a. Liner Adhesive: Comply with ASTM C 916, Type I.
   b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
   c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
   d. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Curb Height: 18 inches.

C. Wind and Seismic Restraints: Metal brackets (Hurricane Clips) compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Seismic Control For HVAC" for wind-load requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Roof Curb: HVAC Contractor shall Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 7 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
   1. HVAC Contractor must shim all roof curbs level and plumb prior to equipment installation. HVAC Contractor will be responsible for cost associated with equipment removal as necessary to make roof curbs plumb and level.

B. Plumbing Contractor shall install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

C. Install piping adjacent to RTUs to allow service and maintenance.

D. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   1. Install ducts to termination at top of roof curb.
   2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Duct Accessories."
   4. Install return-air duct continuously through roof structure.
   5. Install normal-weight, 3000-psi 20.7-MPa, compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm)thick. Concrete, formwork, and reinforcement are specified in Division 3.

E. HVAC Contractors start up representative shall coordinate a review of the RTUs setup configurations with the Automation Contractor prior to the configuration of the units.

3.02 STARTUP SERVICE

A. The HVAC Contractor shall be responsible to provide final start-up of equipment. The HVAC contractor shall contract with the manufacturer to provide final start-up of the equipment. The HVAC Contractor shall acquire and complete the manufacturers "Request for start-up" checklist.

3.03 CLEANING AND ADJUSTING

A. After completing system installation and after final start-up, the HVAC Contractor shall furnish and install new filters one week prior to the grand opening.

END OF SECTION

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SECTION 23 81 26
SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.02 SUBMITTALS

A. Product Data:
   1. Evaporator-fan components.
   2. Condensing unit components.
   3. Refrigeration piping line set.
   4. System controls.

1.03 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."
   2. Applicable requirements in ASHRAE 62.1-2007, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Compressor: Five year(s) from date of Substantial Completion.
   2. Other Parts: One year(s) from date of Substantial Completion.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Wiring Diagrams
   4. Field quality-control reports.
   5. Warranty: Sample of special warranty

PART 2 PRODUCTS

2.01 SPLIT SYSTEMS

A. Manufacturers
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Samsung
      b. Daikin
      c. Lennox

B. Evaporator-Fan Unit:

1. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
    a. Insulation: Faced, glass-fiber duct liner.
    b. Drain Pans: Galvanized steel, with connection for drain; insulated.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
3. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
4. Fan Motor: Multi-speed.
5. Filters: 1 inch (25 mm) thick, in fiberboard frames.
6. Condensate Drain Pans:
    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
        1) Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight steel.
7. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    a. Minimum Connection Size: NPS 1 (DN 25).
    b. Provide unit with manufacturers condensate pump.
    c. Pan-Top Surface Coating: Asphaltic waterproofing compound.
    d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

C. Air-Cooling, Compressor-Condenser Unit:
1. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 35 deg F (7 deg C).

D. Accessories:
1. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
2. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
    a. Minimum Insulation Thickness: 1/2 inch (13 mm) thick.
    b. Exterior Protective Jacketing: 0.016-inch thick aluminum cladding in accordance with ASTM C 1729.

2.02 COLD SPA SPLIT SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Aqua Logic
2. American Chillers

B. Evaporator-Heat Exchanger:

1. Packaged shell-and-tube heat exchanger mounted on factory vertical stand, pre-wired digital temperature controller and flow switch and pre-plumbed piping connections.

C. Air-Cooling, Compressor-Condenser Unit:
1. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 0°F.

D. Accessories:
1. Pre-programmed digital single stage temperature controller with LED display.
2. Water flow switch, shipped loose with unit.
3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
   a. Minimum Insulation Thickness: 1/2 inch (13 mm) thick.
   b. Exterior Protective Jacketing: 0.016-inch thick aluminum cladding in accordance with ASTM C 1729.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install compressor-condenser components on angle iron frame securely attached to building wall.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.03 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. 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. Remove malfunctioning units, replace with new components, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 23 82 19
FAN COIL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes fan-coil units and accessories.

1.02 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Wiring Diagrams
   4. Field quality-control reports.
   5. Warranty: Sample of special warranty

PART 2 PRODUCTS

2.01 DUCTED FAN-COIL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Daikin
   2. Lennox
   3. Samsung

B. Evaporator-Fan Unit:
   1. Concealed-Unit Chassis: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling elements, controls, and accessories; wired for single power connection with control transformer.
   2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
   3. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
   4. Fan Motor: Multi-speed.
   5. Condensate Drain Pans:
      a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      b. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight steel.

6. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    a. Minimum Connection Size: NPS 1-1/4" (DN 25).
    b. Provide unit with manufacturers condensate pump.

C. Air-Cooling, Compressor-Condenser Unit:
1. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 0°F.

D. Accessories:
1. Controller: Wired remote controller with digital display, field mounted to side of unit.
2. Remote sensor kit with 40ft plenum rated control cable.
3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
    a. Minimum Insulation Thickness: 1/2 inch (13 mm) thick.
    b. Exterior Protective Jacketing: 0.016-inch thick aluminum cladding in accordance with ASTM C 1729.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install compressor-condenser components on angle iron frame securely attached to building wall.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts" Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.03 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. 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. Remove malfunctioning units, replace with new components, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

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SECTION 23 83 16.02
RADIANT-HEATING (SNOW & ICE MELT) HYDRONIC PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Snow and ice melting systems (SIM), where shown on the Drawings and Schedules, shall be hydronic, and shall include the following:
   1. Crosslinked polyethylene (PEXa) piping.
   2. Distribution manifold(s) with balancing and flow control valves where required.
   3. Pipe-to-manifold compression nut fittings.
   4. Cold-expansion and compression-sleeve fittings.
   5. Pipe fasteners as approved by the manufacturer of the SIM PEXa piping.
   6. Controls.
   7. Supervision and field engineering required for the complete and proper function of the system.

1.02 REFERENCES

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASTM – American Society for Testing and Materials
   1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
   3. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
   4. ASTM F2080 – Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe.

C. CSA – Canadian Standards Association
   1. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
   2. CSA B214 – Installation Code for Hydronic Heating Systems.

D. DIN – German Institute for Standardization (Deutsches Institut für Normung)
   1. DIN 4726 – Plastic Piping Used in Warm Water Floor Heating (Warmwasser-Fußbodenheizungen und Heizkörperanbindungen - Rohrleitungen aus Kunststoffen).

E. ICC – International Code Council

F. ISO – International Organization for Standardization
   1. ISO 9001 – Quality Management Systems – Requirements.

G. ULC – Underwriters' Laboratories of Canada
   1. CAN/ULC S102.2 – Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials.
   2. CAN/ULC S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

H. PPI – Plastic Pipe Institute
   1. PPI TR-3– Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

1.03 DEFINITIONS

A. Crosslinked polyethylene, commonly abbreviated PEX, is made from high density polyethylene (HDPE). Crosslinking is accomplished during manufacturing. Crosslinking enhances the physical & mechanical properties of the polymer. The high-temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance, and resistance to brittle fracture are enhanced. The required degree of crosslinking, according to ASTM Standard F876-07, is between 70 - 89%. This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.
   1. Submit manufacturer's instructions for installation.
   2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.

B. Submit computer-generated SIM system design indicating heat flux, pipe sizing, spacing, flow rates and temperatures. SIM design calculations shall be performed on pipe manufacturer’s software.

C. Drawings: Provide plans drawn to scale for all installation areas.
   1. Indicate dimensions, descriptions of materials, general construction, component connections, anchorage methods and installation procedures.
   2. Indicate design, schematic layout of system, including equipment, critical dimensions and piping/slab penetration details as well as details for protecting exposed PEX piping.

D. Certification:
   1. Submit independent certification results for the piping systems from an accredited independent testing laboratory.
   2. The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
   3. Fittings shall be third-party certified to applicable referenced standards as part of the manufacturer’s PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.
   4. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be certified to ASTM F2080.

E. Maintenance Instructions: Submit instructions for finish maintenance. Note: Consider using other words for “finish maintenance” – the meaning is unclear.

1.05 QUALITY ASSURANCE

A. Manufacturer: Must be a company specializing in the Work of this Section with a minimum of 5 years documented experience.

B. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.

C. Crosslinked polyethylene (PEXa) pipe shall conform and be certified to ASTM F876, F877 and CSA B137.5, and shall have the PPI TR-3 listing. Pipes with an oxygen diffusion barrier shall conform to the requirements for oxygen permeability DIN 4726 and shall also have the PPI TR-3 listing.

1.06 DELIVERY STORAGE AND HANDLING

A. Deliver and store piping and equipment in shipping containers with labeling in place.
   1. Pipe shall be kept in original shipping boxes until required for installation.

B. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.
   1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
   2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
   3. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
   4. Piping shall not be dragged across the ground or other surfaces and shall be stored on a flat surface with no sharp edges.

C. Protect materials from damage by other trades.

D. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.07 WARRANTY

A. Provide manufacturer's standard written warranty.
   1. To repairing or replacing the defective product in question or providing a refund of the defective product’s purchase price.
   2. The radiant heating pipe manufacturer shall warrant the crosslinked polyethylene piping to be free from defects in material and workmanship for a period of twenty-five (25) years.
   3. Cold-expansion compression-sleeve fittings shall be warranted to be free from defects in material and workmanship for a period of twenty-five (25) years.
   4. All manifolds, distribution headers, thermostats and actuators shall be warranted to be free from defects in material and workmanship for a period of one (2) years starting at completion of successful pressurized water tests immediately following system installation.

1.08 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
   1. Product data
   2. Product certificates
   3. Field quality-control reports.
   4. Warranty: Sample of special warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. REHAU
   2. Uponor Wirsbo Co.
   3. Watts Radiant, Inc.; a division of Watts Water Technologies, Inc.
   4. Zurn Plumbing Products Group.

2.02 PIPING

A. Snow and ice melt system pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876, ASTM F877 and CSA B137.5.

B. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C), and 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C).

C. When required, pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.32 mg/m2/day at 104°F (40°C) water temperature, in accordance with DIN 4726.

D. Bend Radius:
   1. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.
   2. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.

E. Compliant to the following standards:
   1. ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).
      a. UL Design No. L588: 1-hour wood frame floor/ceiling assemblies
      b. UL Design No. K917: 2-hour concrete floor/ceiling assemblies
      c. UL Design No. U383: 1-hour wood stud/gypsum wallboard wall assemblies
      d. UL Design No. V461: 1-hour steel stud/gypsum wallboard wall assemblies

F. Pipe to have a Flame Spread Index and a Smoke Developed Index listing to ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada).

G. PEX-B piping is NOT allowed.

H. All piping shall be labeled for type, size psi ratings, etc.

2.03 FITTINGS

A. Fittings shall be third-party certified to applicable standards ASTM F877, ASTM F2080 and CSA B137.5, with independent listings from NSF and/or CSA as applicable.

B. Compression nut manifold fittings shall be manufactured of brass with a barbed insert and a split compression ring.

C. Compression-sleeve fittings shall be manufactured of brass and shall be approved by the piping manufacturer to be part of a proven cataloged system.

D. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be cold-expansion compression-sleeve fittings certified to ASTM F2080. Where required by the manufacturer, fittings shall be protected from external environmental conditions.

2.04 DISTRIBUTION MANIFOLDS

A. Material: Distribution manifolds shall be manufactured of stainless steel and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

2.05 VALVES

A. Main Shutoff Valves:
   1. Factory installed on supply and return connections.
   2. Two-piece body.
   3. Body: Stainless Steel.
   4. Ball: Stainless Steel.

5. Seals: PTFE.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

B. Manual Air Vents:
1. Body: Stainless Steel.
2. Internal Parts: Nonferrous.
3. Operator: Key furnished with valve, or screwdriver bit.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Balancing Valves:
1. Body: Stainless Steel, ball or plug, or globe cartridge type.
2. Ball or Plug: stainless steel.
3. Globe Cartridge and Washer: Brass with EPDM composition washer.
4. Seat: PTFE.
5. Visual Flow Indicator: Flowmeter with visible indication in a clear plastic cap at top of valve.
6. Handle Style: Lever or knob, with memory stop to retain set position if used for shutoff.
7. CWP Rating: Minimum 125 psig.
8. Maximum Operating Temperature: 250 deg F.

D. Zone Control Valves:
1. Body: Plastic or Stainless Steel, ball or plug, or globe cartridge type.
2. Ball or Plug: Brass or stainless steel.
3. Globe Cartridge and Washer: Brass with EPDM composition washer.
4. Seat: PTFE.
5. Actuator: Replaceable electric motor.
6. CWP Rating: Minimum 125 psig.
7. Maximum Operating Temperature: 250 deg F.

E. Thermometers:
1. Mount on supply and return connections.
2. Case: Dry type, metal or plastic, 2-inch diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, connecting element and pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Black metal.
7. Window: Plastic.
8. Connector: Rigid, back type.
9. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem.
10. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

F. Mounting Brackets: Copper, or plastic or copper-clad steel, where in contact with manifold.

2.06 PIPING SPECIALTIES

A. Cable Ties:
1. Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

2. Minimum Width: 1/8 inch.
3. Tensile Strength: 20 lb, minimum.
4. Temperature Range: Minus 40 to plus 185 deg F.

2.07 CONTROLS

A. Automatic SIM Detector and Melting Controls
   1. SIM control shall use low-voltage devices to monitor outdoor ambient, slab, fluid supply and/or return temperatures, as well as an automatic snow and ice detector to detect moisture in the SIM zone.
   2. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for Idle and Melting mode.
   3. Connection to output devices shall be as per the recommended installation of the SIM control, as part of a proven cataloged system.

B. Manual SIM Detector Controls
   1. SIM control shall use low-voltage devices to monitor outdoor ambient and slab or thermal mass temperatures. SIM control to have a timed on/off switch that is turned on by system operator then shuts system off after a pre-set time interval.
   2. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for Idle and Melting mode.
   3. Connection to output devices shall be as per the recommended installation of the SIM control, as part of a proven cataloged system.

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX SIM systems and appropriately licensed for the jurisdiction where the installation will take place.

3.02 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

B. Beginning of installation means acceptance of existing conditions.

3.03 PREPARATION

A. Coordinate with related trades and manufacturer’s recommendations with regard to installation in conjunction with:
   1. Reinforcing wire mesh or rebar.
   2. Precast or existing concrete sub-grade.
   3. Asphalt or other hot mix.
   4. Patio pavers.
   5. Preparation of space for manifold installation.
   6. Mounting outdoors or in an unheated indoor environment.

3.04 INSTALLATION

A. Install in accordance with manufacturer's published installation manual and/or published guidelines and final drawings.

B. Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible.

C. Route piping in an orderly manner, according to layout and spacing shown in final drawings.

D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where fittings are installed within the thermal mass, they shall be wrapped in chloride-free tape or sealed within a heat-shrink material approved by the manufacturer.

E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a thermal mass shall be a minimum of 3/4 in (19 mm) above the top of PEX heating pipes. Fasten piping at no more than 3 ft (90 cm) intervals, being careful not to twist the pipe. In thin concrete slabs, secure piping every 2 ft (60 cm). Use only fasteners supplied or approved by the manufacturer of the PEX pipe.

F. Piping that shall pass through expansion joints shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 in (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.

G. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 in (15 cm) into the floor and exiting by a minimum of 6 in (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.

H. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon as possible and record circuit lengths. Circuits shall be labeled to indicate circuit length and serviced area.

I. The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper SIM operating temperatures.

3.05 FIELD QUALITY CONTROL

A. Filling, Testing & Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.

B. Pressure gauges used shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.

C. Air Test
   1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
   2. Do not exceed 150 psig.
   3. Use liquid gas detector or soap solution to check for leakage at manifold connections.

D. Water Test
   1. Purge air from pipes.
   2. Charge the completed, yet unconcealed pipes with water.
   3. Take necessary precautions to prevent water from freezing.
   4. Check the system for leakage, especially at pipe joints.

E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.
   1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
   2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.

F. After successfully performing the preliminary test, perform the main pressure test immediately.

1. The main pressure test shall last 2 hours.
2. The test pressure shall be restored and shall not fall more than 3 psig after 2 hours.
3. No leakage shall be detected.

G. Pressure shall be maintained and monitored during installation of the thermal mass.
1. If any leak is detected during installation of thermal mass, leak shall be found immediately, and the area cleared for repair using manufacturer's approved repair coupling.
2. Retest before covering repair.

H. Complete inspection and furnish test reports supplied by the manufacturer of the system.

I. All low-voltage equipment shall be tested. The following 3 items should be checked at a minimum:
1. Inputs
2. Outputs
3. Sequence of Operations

3.06 CLEANING

A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

B. Comply with manufacturer's recommendations.

3.07 PROTECTION

A. Protect installation throughout construction process until date of final completion.

B. Replace components that cannot be repaired.

END OF SECTION

SECTION 25 00 00
DIVISION 25 TABLE OF CONTENTS

DIVISION 25 – INTEGRATED AUTOMATION SYSTEMS

25 10 00 – BAS Network Systems
25 20 00 – BAS Instrumentation
25 90 00 – BAS Sequence of Operations

END OF SECTION

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SECTION 25 08 00
COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

J. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Third-Party Integration Systems
   2. Network Supervisory Controllers
   3. Unitary Controllers
   4. Field Devices
   5. Automation Software
   6. Sequence of Operations

END OF SECTION

SECTION 25 10 00
BAS NETWORK SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes control equipment and components for a complete Building Automation System (BAS), including control components for terminal heating and cooling units not supplied with factory-wired controls as well as integration of factory-wired controls.

B. Materials covered by this Section are to be purchased direct from the supplier unless noted otherwise. This contractor shall review and adjust shop drawings as necessary, coordinate shipping dates, receive products on the job site, store the product until installation and shall install the product as if it had been purchased by the contractor.

1.02 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.

C. Division 01, 13, 14, 21, 22, 23, 26, 27, and 28 Specification Sections, apply to this Section.

D. Life Time Fitness “Owner’s Project Requirements” document.

E. Section 23 09 34 – VARIBLE FREQUENCY DRIVES

F. Section 25 20 00 - BAS INSTRUMENTATION

G. Section 25 90 00 - BAS SEQUENCE OF OPERATIONS

1.03 REFERENCE STANDARDS

A. IEEE 802.3 - IEEE Standard for Ethernet; 2022 (Corrigendum 2024).

B. ISA-5.1 - Instrumentation and Control Symbols and Identification; 2024.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

E. Comply with all current codes, ordinances, regulations for the jurisdiction having authority.

F. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

G. ASHRAE Standard 90.1 - Energy Standard for Buildings

H. ASHRAE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality

I. ASHRAE Standard 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks

J. ASHRAE Standard 135.1 - Method of Test for Conformance to BACnet

K. ASHRAE Standard 41.8 - Standard Methods for Liquid Flow Measurement

L. ASHRAE Standard 202 - Commissioning Process for Buildings and Systems

M. ASHRAE Guideline 36-2021 - High-Performance Sequences of Operation for HVAC Systems

N. IECC - International Energy Conservation Code

O. ICC 2018 International Green Construction Code

1.04 DEFINITIONS

A. BACnet: A data communication protocol defined by ASHRAE Standard 135.

B. BACnet/IP: Annex J of Standard 135 for transmission of BACnet messages over TCP/IP networks.

C. BAS: Building Automation System.

D. DDC: Direct Digital Control.

E. Gateway: Communication hardware and/or software for translating two different protocols.

F. I/O: Input/Output.

G. Workstation: A computer PC where the personnel operating the building DDC systems can interface with the systems and adjust setpoints and operating conditions.

H. MS/TP: Master Slave / Token Passing.

I. Native BACnet Device: A BACnet system that uses BACnet devices at all levels and communicates without the need for intermediary gateways.

J. PID: Proportional, integral, derivative control loop algorithm.

K. Router: A component that joins two or more networks using different LAN technologies.

L. RTD: Resistance temperature device.

M. Server: A computer on which the DDC operating system interfaces with controllers and the internet.

1.05 SCOPE OF WORK

A. This project requires the installation of a new Building Automation System constructed using a Niagara Framework with BACnet Field Level Devices. These devices, design, installation drawings, programming, and startup services shall be provided by Honeywell Multisite using the OPUS Magnum a Niagra based framework. The BAS shall utilize one or multiple JACE controllers, networked with a Niagara Framework Supervisor and compatible field devices.
   1. In the event multiple JACE controllers are used one JACE shall be designated as primary and all graphics/interface shall be through the primary unit.

B. The Contractor will be required to perform the following:
   1. Furnish, install, configure and commission a new Niagara Framework with BACnet fully programmable and application specific DDC controllers for the equipment identified in the DI drawings, including all components, software and applications required to meet the sequence of operation and the design/performance intent of the systems.
   2. Provide Application Specific Controllers (ASCs) and Programmable Control Units (PCUs) as specified herein and as indicated on the DI drawings. Provide I/O and ancillary devices as specified herein, as indicated on the DI drawings, and as necessary to perform the sequences of operation. If any devices are required to achieve the specified sequence of operation and not specified on the drawings or specifications the controls contractor should include that equipment in their bid. Provide BACnet or Niagara Framework products that communicate on MS/TP or TCP/IP channels to meet the functional specifications.
   3. Furnish and install electronic energy meters to monitor energy usage and measure the efficiency of energy use within the facility as indicated on the DI drawings.
   4. Furnish and install all low voltage step-down transformers with associated low voltage connections, power supplies and power/communication/input/output cabling necessary for the control system.

5. Furnish and install conduit, junction boxes, fittings, panels, enclosures, and hardware as specified in these specifications, on the drawings and as required by Code.
6. Provide Graphical User Interface Development for all of the devices identified above and illustrated within the DI drawings.
7. It is the contractor's responsibility to review all of the design documents and specifications and report any discrepancies to the owner.

1.06 GENERAL INSTALLATION

A. Contractor shall implement a Niagara Framework based open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

B. The Owner shall receive ownership of all job specific configuration documentation, data files and application-level software developed for the project. This shall include all custom, job specific software code, databases and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for admin and programming level access to any component or software program shall be provided to the Owner.

C. It is the Owner's intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification (TCP) to work on Niagara Framework systems

D. All hardware and field level devices installed, (i.e., ASCs, PDUs), for the project shall not be limited in their ability to communicate with a specific brand of Niagara Framework device. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replace of or in parallel with existing components.

E. Provide and install all wiring required for a complete system, including communication bus, analog points, digital points, low voltage power, emergency power, and spare communication bus. Splices are not permitted within the IAS FAC LAN or DLN communication cables. Only continuous bus topologies, MS/TP or continuous homeruns are allowed for these networks. Capacity of any bus shall be limited to 80% of the allowable device count to allow for future minor modifications or expansions to the network.

F. Provision of all documentation called out in these specifications including, but not limited to, submittals, O&M manuals, commissioning submittals, CAD based as-built documentation, and training manuals. Provide electronic files on electronic media.

G. Training of facility personnel, and or maintenance contractor, on the operation and maintenance of the system. Refer to Section 3.11 for further training requirements.

H. The repair of all finished surfaces effected as a result of BAS related installation work. This includes but is not limited to carpet, drywall, paint, ceiling tiles, furniture, and the like.

I. System point to point check out, verification and documentation. Assist the Owner/LTF CxM, and/or TAB Firm in verification and functional performance testing and GUI acceptance testing. Refer to 25 08 00 for further requirements.

J. Graphical User Interface Development. The Contractor shall develop the graphics, tools, features, and network integration as required.

1.07 CONTROL DIAGRAMS AND SCHEDULE

A. The automation diagrams and schedules are an integral part of the control system design. Together the specifications, design drawings and schedules will provide a complete design. It is important that these documents be completed to a level of detail that will enable the performance expectations for the project to be realized.

B. Refer to BAS and Mechanical, Design and As-Built Drawings for information on the components and intended control functions.

1.08 SEQUENCE OF OPERATIONS

A. Program each Niagara Framework Network Controller, and third-party ASC, PCU, device, etc., to perform the sequences of operation provided in Section 25 90 00 SEQUENCE OF OPERATIONS and the DI drawings. Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the point lists.

B. The Contractor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

C. The Contractor shall coordinate a review of the RTU’s setup configurations with the Mechanical Contractors start up representative prior to the configuration of the units.

1.09 BUILDING AUTOMATION SYSTEM POINTS LIST

A. Refer to the DI drawings for all equipment points which should be included in the graphic interface.

B. Alarms shall be provided as indicated on the matrix.

1.10 PARTS LIST

A. As part of the submittal, provide an accurate parts list including manufacturer, model number and quantity for all hardware and software.

1.11 QUALITY ASSURANCE

A. Provide a Niagara Framework as the basis of the new BAS. The Contractor shall be fully certified in the development and customization of the Niagara Framework software.

B. All microprocessor-based control products used shall conform to BTL Certified communication standards and Niagara Framework.

C. The BAS and components shall be listed by Underwriters Laboratories (((UL 916))) as an Energy Management System.

D. Functionality and Completeness: Contractor shall furnish and install all hardware, software and programming necessary to provide a complete and functioning system as specified. Contractor shall include all hardware, software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these Specifications.

1.12 INSTALLER’S QUALIFICATIONS

A. Installer's Qualifications: The Contractor shall have a successful history in the design and installation of Niagara Framework based Building Automation Systems to provide web browser monitoring and control of BACnet field level devices. Contractor must demonstrate experience in BAS installations for not less than 5 years and in DDC installation projects with point counts equal to this Project and systems of the same character as this Project.

B. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least three (3) projects of similar size and complexity. Submittals shall document this experience with references. Provide evidence of Niagara TCP certification as part of the submittal process.

1.13 BID PACKAGE SUBMITTAL

A. Provide the following submittals as part of the bid package.
   1. Proposed device schedule including all hardware and software.
   2. Qualifications.
   3. One-line diagram indicating how the new Niagara Framework network controllers will integrate with any existing BAS BACnet field level devices.
   4. An overall sequence of the construction as it pertains to the installation of the Building Automation System.

1.14 SUBMITTALS

A. General: Submit under provisions of Division 01.

B. Electronic Submittals: BAS control submittals and operation and maintenance (O&M) information shall be provided in electronic format as follows:
   1. Drawings and Diagrams:
      a. Shall be provided in .PDF Format.
      b. Product Data Sheets shall be provided in .PDF Format.

C. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate items.

D. Submit a list of no less than three similar projects, which utilize the Niagara Framework for Enterprise connectivity to provide an Integrated Automation System that consists of web-browser control and monitoring of the proposed BACnet field level devices. These projects must be on-line and functional such that representatives from the Owner can observe the Integrated Automation System and Interface in full operation. Include proper references and contact numbers of these reference projects.

E. Submit validation which indicates the successful completion of the Niagara Framework TCP certification course.

F. Submit resumes of installing staff indicating passing certificates for training on the BACnet and Tridium TCP certification line of controls to be installed as part of this project.

G. Product Data: Submit manufacturer's technical product data for each Niagara Framework based Network Controller, control device, sensor, actuator, relay, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

H. Products: Within twenty-one (21) days after date of execution of Sub-Contractor agreement, submit for acceptance a list of all material and equipment manufacturers whose products are proposed, as well as names of all subcontractors whom the Contractor proposes to employ.

I. Submit documentation indicating BACnet Testing Laboratories (BTL) compliance and include Protocol Implementation Conformance (PIC) Statements.

J. Submit Shop Drawings for each control system.

K. Control Logic Documentation:
   1. Provide a written description of each control sequence.
   2. Submit a BAS Start-Up Test Agenda and Schedule for review and approval.

L. As-Built Record Documents:
   1. Provide record copies of product data and control Shop Drawings updated to reflect the final installed condition.
   2. Record documents shall include panel layout diagrams including wiring terminal connections. This should be on a 42x30 pdf drawing.
   3. Accurately record actual set points and settings of controls, final sequence of operation, including changes to programs made after submission and approval of Shop Drawings and including changes to programs made during specified testing.
   4. Record copies shall include individual floor plans with device (controllers, routers, sensors, etc.) locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring.
   5. Network Riser Diagram including controller addresses.
   6. Valve Schedule including: Tag, system served, line size, flow rate (GPM), valve size, type of connection, valve type, flow pattern, supply power, manufacturer, valve and actuator part numbers, fail position, design coefficient, trim material.

1.15 SYSTEM ARCHITECTURE

A. The system provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Facility Local Area Network (FAC LAN) and Device Level Network (DLN) shall be based on industry standard open platforms as specified herein and utilize commonly available operation, management and application software. All software packages and databases shall be licensed to the Owner to allow unrestricted maintenance and operation of the BAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.

B. The system architecture shall expand on the existing BAS, which is based on the Niagara Framework and consists of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) that supports NCs, PCUs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable.
   1. WAN: Internet-based network connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser. This is an existing infrastructure and Contractor is not required to configure any components of this WAN.
   2. Facility Local Area Network (FAC LAN): The FAC LAN shall be an Ethernet-based, 1 GBS Ethernet LAN connecting Local NCs, IAS Server and OWSs. The FAC LAN serves as the backbone for the NCs communications path and as the connection point to the WAN. The Owner shall provide a FAC LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support Gigabit Ethernet throughput.
   3. Device Level Network (DLN): Network used to connect PCUs and ASCs. These shall be Master/Slave Token/Passing (MS/TP) devices as defined in the BTL standard. A maximum of 38.4k bps shall be utilized.
   4. ARCnet DLNs shall not be acceptable.
   5. LON Works based devices and/or technology is not acceptable.

C. Remote Data Access: The system shall support the Internet Browser-based remote access to the building data. The IAS contractor shall coordinate with the Owner’s IT department to ensure all remote browser access (if desired by the owner) is protected with the latest Niagara Software updates and a VPN (Virtual Private Network) must be installed to protect the owner’s network from cyber-attacks.

D. Browser-based access: A remote/local user using a standard browser will be able access all control system facilities and graphics via the WAN or direct connection, with proper username and password. Only native Internet browser-based user interfaces, HTML5, that do not require plug-ins (thin clients) are acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer or Chrome.

E. Graphics: Graphics shall include all pieces of mechanical equipment with a dedicated graphics page showing all points as indicated on the DI drawings.

F. Niagara Framework Control Systems Server (CSS): A server that maintains the systems configuration and programming database. It shall allow secure multiple access to the control information.

G. The communication speed between the controllers shall set up to meet each manufacturer's requirements for polling time and data transmission.

H. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server that resides on the FAC LAN. User tools for DLN and FAC LAN management shall be provided and licensed to the Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.

1.16 WARRANTY

A. The entire BAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within 12 months from the date of substantial completion the installed equipment is found to be defective in operation, workmanship or materials, the Contractor shall replace, repair or adjust the defect at no cost to the Owner.

B. The warranty period for work and systems of this project shall commence after functional performance testing is complete.

C. Corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

D. The Owner reserves the right to make changes to the BAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

E. At no cost to the Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware and hardware PRODUCTS. Prior to the closeout of the warranty period, the BAS contractor shall meet with the owner's representative to address any questions or concerns and offer ongoing Software Maintenance Services to the owner.

F. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

1.17 STAND-ALONE FUNCTIONALITY

A. All controllers provided shall be capable of running standalone in the event of a loss of communications. Equipment fail position shall be set based on controls schematic.

B. Third party interfaces
   1. Manufacturer third party interfaces shall be limited to equipment which the BAS contractor cannot or has not been contracted to control directly via DDC controllers. This equipment shall include the following. Chillers, Boilers, ERUs, MAUs, VFDs, Utility Meters, Generators, Energy Monitors, Lighting Control Systems.

1.18 ENERGY MANAGEMENT APPLICATIONS

A. The BAS shall have the ability to perform energy management routines via preprogrammed function blocks or template programs.

1.19 UNIFORMITY

A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Niagara Framework version 4.10 or above.
   2. Life Time Property Development Approved Equal.

B. Acceptable Distributors:
   1. Honeywell Novar Multisite
      a. Phil McConnel (608.354.7350 / Philip.McConnell@Honeywell.com)
      b. Jason Nobbe (JNobbe@lt.life)
   2. Life Time Property Development Approved Equal.

C. Acceptable Integrators:
   1. Licensed Contractor, Corporate Facilities Operations approved.
   2. Life Time Property Development Approved Equal.

2.02 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Drawings or Specifications specifically allow existing materials to remain in place.

2.03 SUBSTITUTIONS

A. Wherever the words “for review” or “for acceptance” are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus to the Owner and secure their approval before the apparatus is ordered. Refer to general condition requirements for substitutions.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. These specifications call out certain duties of the Contractor and any subcontractor. They are not intended as a material list of all items required by the Contract.

3.02 INSTALLATION

A. Utilize licensed installers and comply with Division 26 electrical specifications for conduit, junction box, and wiring requirements.

B. Provide related items and work indicated on the DI drawings and items and work called for in this Division of the Specifications. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start up, configuration, programming and commissioning coordination on each control product and system to provide fully operable systems in accordance with the specified functional performance.

C. Installation shall be in accordance with manufacturer's published recommendations and shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

D. The DI drawings show the general arrangement of the respective systems. Follow these Drawings as closely as actual building construction and the work of other trades will permit. Provide devices, power, fittings, sensors, controllers, wiring and accessories, which may be required but are not shown on the Drawings or specified herein. The Contractor shall be responsible for achieving the sequence of operations and intent of the system design.

E. All installation shall be in accordance with manufacturer's published recommendations.

F. Limit LAN cable lengths to no longer than 80% of the longest dimension published by the manufacturer of the cable between the most remote network nodes.

G. Comply with all rules, guidelines and procedures defined by the Owner's IT authority.

3.03 DIGITAL CONTROL PANELS, CONTROLLER QUANTITY AND LOCATION

A. Individual Digital Control Panels (DCP) are referenced to indicate allocation of points to each DCP and DCP location. Digital control panels shall consist of one or multiple controllers to meet requirements of this Specification.

B. Contractor shall extend power to the DCP from an acceptable power panel (coordinate with Division 26).

3.04 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

A. Contractor shall thoroughly and completely configure BAS system control devices, software, supplemental software, application programming, network communications, CSS, OWS, and network communications to permit the functional requirements of the BAS herein specified. The setup shall include as a minimum, the following network management procedures:
   1. Automatic backup of the DDC System database to appropriate media.
   2. Program, load and debug all software installations, including integration of third-party applications (e.g. analytics and energy management).
   3. Network user auditing routine.

3.05 SURGE PROTECTION

A. Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all NCs, routers and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10 % above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

3.06 CONTROL POWER SOURCE AND SUPPLY

A. BAS Contractor shall provide all power source wiring required for operation of all equipment and devices provided under Division 25 and the DI Drawings.

3.07 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION AND CLEANING

A. All products and materials shall be new, clean, and free of defects, damage and corrosion.

B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.

3.08 SITE CLEAN UP

A. At conclusion of each day's work, and at the request of the owner, clean up and remove from the site all rubbish, debris and trash accumulated during the day as a result of work of the Contractor.

B. Marks on walls or ceiling tiles caused by the Contractor shall be cleaned by the Contractor. Ceiling tiles, drywall, carpet, paint, and all architectural finishes damaged by the Contractor shall be replaced by the Contractor.

3.09 CHECK OUT (CCO) START-UP TESTING, ADJUSTING, CALIBRATION

A. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall conduct the CCO which addresses the start-up, testing, adjustments, and calibrations of all work and/or systems under this Contract.

B. All CCO testing procedures shall be documented in the CCO report to be provided by the contractor to the Owner/LTF CxM.

3.10 SUMMARY OF IAS ACCEPTANCE PROCEDURE

A. Submit product data, Shop Drawings, logic documentation, and sample graphics to the Engineer of Record, and receive approval.

B. Install BAS. Obtain Owner/LTF CxM acceptance of each phase of installation when installation consists of a renovation in an occupied space.

C. Submit as-built record documents.

D. Provide the Owner/LTF CxM an agenda and schedule of CCO testing activities for approval and coordination.

E. Provide written notice that the system is ready for Functional Performance Testing (FPT). Schedule BAS Demonstrations and Owner/LTF CxM Commissioning.

F. Demonstrate BAS systems to Owner/Engineer. Perform Functional Performance Testing including sequence of operation, point to point verification to graphical interface, historical data logging, and alarms.

G. Owner/LTF CxM to provide detailed punch list to contractor.

H. Contractor to repair issues on Owner/LTF CxM punch list in seven (7) calendar days.

I. Contractor provides all usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to the Owner.

J. Contractor provides training to Owner on all aspects of the IAS including architecture, devices, software, final sequences, and modes of operation.

K. Revise and re-submit as-built record Drawings and O&M Manuals.

L. When Functional Performance Testing Final is complete and all record drawings, submittals, and O&M Manual are submitted this will constitute acceptance and the beginning of the warranty period.

3.11 TRAINING

A. Training Allowance: Provide add service for not less than eight (8) hours formal training to the Owner's designated operations personnel.

B. Additional training shall be available for purchase and attendance by the Owner or designee. This additional training shall be of the same curriculum as the training courses provided by the manufacturer to the System Integrator.

C. Training shall not be provided unital after the completed installation and verified correct operation (FPT) by the owner's third-party commissioning agent. Coordinate with GC for scheduled owner training.

D. Meet all applicable Training requirements of Division 01 and the following:

E. Instruct the operators how to accomplish control of the system. Include basic troubleshooting and override of equipment and controls in the event of system failure.

F. Trainers - Persons conducting the training shall be knowledgeable in the workings of the system, and shall be regularly engaged in training exercises, to provide effective training. Submit names and qualifications of trainers for Owner review prior to scheduling training.

G. Training Manuals - Include the following in training manuals.
   1. Completed FPT Procedure.
   2. "As-installed" Drawings.
   3. Manufacturer's Operation Manuals.

END OF SECTION

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SECTION 25 20 00
BAS INSTRUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes automation device requirements for whole facility automation, including subsystems and equipment.

1.02 RELATED DOCUMENTS

A. Section 25 10 00 - BAS NETWORK SYSTEMS

B. Section 23 09 34 - VARIABLE FREQUENCY DRIVES

C. Section 25 90 00 - BAS SEQUENCE OF OPERATIONS

1.03 REFERENCE STANDARDS

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

1.04 DEFINITIONS

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

1.05 SCOPE OF WORK

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

PART 2 PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

A. All equipment shall meet or exceed the requirements listed below. Equipment shown on the Process Automation drawings shall conform to section 2.02.

B. Temperature Sensors:
   1. Temperature Sensors provided by the equipment manufacturer shall meet manufacturers thermistor standards.
   2. Temperature Sensors provided by the controls contractor shall be 10k ohm Type III thermistors.
   3. Temperature sensing elements shall be accurate within plus or minus 1.0 °F over their expected sensing range for all applications.
   4. Space Sensors shall be provided where shown on plans and shall be mounted above finished floor as directed by the Architect. Provide wall guards as called for on plans. Refer to Installation section for further details.

C. Relative Humidity Sensors:
   1. Relative humidity sensors shall be thin-film capacitance type with accuracy of 2% over the 20% to 95% range for all applications.
   2. All equipment sensors shall be provided by the equipment manufacturer where possible. When not possible, the output signal shall be 0-10 VDC, proportional over full range (4 to 20 mA as approved).

D. Carbon Dioxide Sensors:
   1. Performance Criteria:
      a. Measurement Range: 0 to 2000 ppm.
      b. Accuracy: ±100 ppm.
      c. Repeatability: ±20 ppm.
      d. Drift: ±100 ppm per year.
      e. Output Signal: 0-10 VDC (4 to 20 mA as approved)

f. Proportional signal over the full range.

2. Calibration Adjustments:
   a. Automatic zero compensation and span calibration.
   b. Minimum Adjustment Resolution: ±20 ppm.
   c. Recommended Calibration Interval: 3 years
   d. Maximum Response Time: 60 seconds.
   e. Maximum Warm-Up Time: 15 minutes.

E. Outdoor Air Sensors:
   1. Outdoor air, temperature, and humidity shall be provided to the BAS via National Oceanic and Atmospheric Administration (NOAA) weather stations. Contractor shall determine nearest weather station and submit recommended weather station for approval.

F. Analog Current Sensors:
   1. Analog current sensor shall be loop powered, fully isolated. Sensor through-hole to accommodate appropriate wire size for specific application. Provide with over-range protection. Sensor shall provide accuracy of plus or minus 1.0% of full scale, linearity and repeatability of plus or minus 0.5% of full scale, and response time of no less than 300 milliseconds to 99 percent of full scale.

G. Power Monitors:
   1. Power monitor provided by electrical contractor in electrical panel. Controls contractor shall integrate power monitor with building automation system.
   2. Three-phase type with disconnect/shorting switch assembly, listed voltage and current transformers. Maximum 2% error at 1.0 power factor.
   3. Provide Current Transformers rated for the nominal connected load.
   4. Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display status and alarms and energy usage.
      a. Network Communications Ports: RS-485.
      b. Embedded Native Protocols for Network Communications: ASHRAE 135 BACnet protocol accessible via the communications port.

H. Pressure Transmitters:
   1. Pressure Transmitters shall be solid state piezo resistive silicon suitable for the measured medium, range and pressures of the application, and shall have the following:
      a. Adjustable span and zero.
      b. Accuracy of plus or minus 1.0% of span.
      c. Linearity of plus or minus 0.1% of span.

I. Flow Meters – Natural Gas:
   1. General:
      a. Inline thermal mass flow meter specifically for natural gas with visual display.
      b. Natural Gas Accuracy: ±1%.
      c. Input Power: 12-28 VDC.
      d. Ambient Temperature Range: -40°F to 158°F.
   2. Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display status and alarms.
      a. Network Communications Ports: RS-485.
      b. Embedded Native Protocols for Network Communications: ASHRAE 135 BACnet protocol accessible via the communications port.

J. Flow Meters – Displacement-Type:
   1. Description:
      a. Standard: AWWA C700.

b. Pressure Rating: 150 psig working pressure.
c. Body Design: Nutating disc; totalization meter.
d. Registration: In gallons or cubic feet as required by service type.
e. Case: Bronze.
f. End Connections: Threaded.

2. Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display status and alarms.
   a. Network Communications Ports: RS-485.
   b. Embedded Native Protocols for Network Communications: ASHRAE 135 BACnet protocol accessible via the communications port.

K. Flow Meters – Hydronic:
1. Accuracy:
   a. % of reading at calibrated velocity
   b. ± 1% of reading from 3 to 30 ft/s (10:1 range)
   c. ± 2% of reading from 0.4 to 20 ft/s (50:1 range)
2. Output signals available
   a. 0-10 VDC
3. Electronics enclosure
   a. NEMA4 enclosure
4. Electrical connections
   a. Standard: 10’ of cable with ½” NPT conduit connection
   b. Optional: indoor DIN connector with 10’ of plenum rated cable

L. Pressure Switches – Dry:
1. Static or differential pressure switches shall have a repetitive accuracy of plus or minus 2% of their operating range and shall withstand up to 150 percent of rated pressure. Trip Reset shall be automatic for all applications except, High or Low Static Safeties, in which case Manual Trip Reset is required.

M. Pressure Switches – Wet:
1. Static or differential pressure switches shall have a repetitive accuracy of plus or minus 2% of their operating range and shall withstand up to 150 percent of rated pressure. Actuation shall be adjustable over the operating pressure range. Switch shall have a snap-action dry contact ratedfor the application. Trip Reset shall be automatic.

N. Automation Cables:
1. Insulation:
   a. 300 Volt Class.
2. All cable shall be twisted, shielded, plenum rated.
3. Wire Markers:
   a. Include full wrap self-adhesive type labels on each cable end and on each terminated and un-terminated conductor.

O. Control Cabinets:
1. NEMA rating to match installed locations.
2. Shall maintain Class 2 circuit requirements:
   a. Maximum voltage: 90 Volts
   b. Maximum power: 100 VA
3. Front panel hinge and fitted with a key locking latch.
4. Perforated backboard, supplied with enclosure.

P. Control Labels:

1. Type: Engraved, laminated plastic.
2. Location: All standalone control cabinets
3. Minimum Size: 3/4" by 2-1/2".
4. Text Color: White.
5. Background Color: Black.
6. Minimum Letter Size: 3/8" high.

Q. Raceways:
1. Products: As specified in Division 26.
2. Required Locations:
a. Wire and cable of this section shall be in conduit within any exposed spaces.

R. Relays and Contactors:
1. Relays: General purpose, latching, and time delay types, rated for application.
a. Contacts:
1) Type: Silver-cadmium. Form C.
2) Enclosure: Dustproof.
3) Life Span: One million operations.
b. Operating Time: 20 milliseconds or less.
c. Release Time: 10 milliseconds or less.
2. Contactors: Single coil, electrically operated, mechanically held type, rated for application.
a. Contacts:
1) Type: Double break, silver to silver, protected by arcing contacts.
2) Operating and Release Times: 100 milliseconds or less.
3) Positive Locking: Without use of hooks, latches, and semi-permanent magnets.

S. Current Sensing Relays:
1. Output Characteristic: SPST solid state, normally open.
2. Output Rating: 60 MA, 24 VDC minimum.
3. Trip Point: Adjustable.

T. Aquastats:
1. Features:
a. Switching: SPDT.
b. Contacts: Totally enclosed.
2. Setpoint:
a. Adjustment: External with visible scale.
b. Range: As appropriate for application.
3. Mountings:
a. Immersion Type: In separable well.
b. Surface Type: With adjustable pipe clamp.
4. Differential: 2 °F, fixed.

2.02 SENSORS

A. S01 Wall-Mounted Combination Temperature/Humidity Sensor with Display:
1. Manufacturers:
a. Neptronic TUUB thermostat.
1) White in color for Yoga Studio
2) White in color for Group Fitness Studio
2. This device shall allow the user to set the Yoga Studio class temperature.

B. S02 Wall-Mounted Combination Temperature/Humidity Sensor:

1. Manufacturers:
    a. Equipment Provider as specified in Division 23.
2. This device shall monitor Temperature and Humidity in one device.
3. This device shall have no local display or adjustment capability.

C. S03 Wall-Mounted C02 Sensor:
1. Manufacturers:
    a. Equipment Provider as specified in Division 23.
2. This device shall have no local display.

D. S05 Wall-Mounted Combination Temperature/Humidity Sensor with Display:
1. Manufacturers:
    a. Equipment Provider as specified in Division 23.
2. This device shall monitor Temperature and Humidity in one device.

E. S06 Wall-Mounted Temperature Sensor:
1. Manufacturers:
    a. ACI Part # A/AN-R or equivalent as submitted and accepted
2. This device shall enable the BAS to monitor temperature.
3. This device shall have no local display or adjustment capability.

F. S07 Wall-Mounted Temperature Sensor:
1. Manufacturers:
    a. Luxpro #LV3 or equivalent as submitted and accepted
2. This device shall be a line voltage, cooling only thermostat have local display and adjustment capability.

G. S08 Duct-Mounted Temperature Sensor:
1. Manufacturers:
    a. Equipment Provider as specified in Division 23.

H. S09 Duct-Mounted Temperature Sensor:
1. Manufacturers:
    a. ACI Part # A/AN-D-8-PB or equivalent as submitted and accepted

I. S10 Duct-Mounted Pressure Sensor:
1. Manufacturers:
    a. MAMAC Part # PR-276-R10-VDC or equivalent as submitted and accepted

J. S11 Duct-Mounted CO2 Sensor:
1. Manufacturers:
    a. Equipment Provider as specified in Division 23.

K. S12 Plenum-Mounted Pressure Sensor:
1. Manufacturers:
    a. MAMAC Part # PR-274-R2-VDC or equivalent as submitted and accepted

L. S13 Ceiling-Mounted Pressure Port:
1. Manufacturers:
    a. ACI Part # A/SP-PUP or equivalent as submitted and accepted

M. S14 Pipe-Mounted Immersion Temperature Sensor:
1. Manufacturers:
    a. ACI Part # A/AN-IM-2.5-PB or equivalent as submitted and accepted

N. S15 Pipe-Mounted Immersion Temperature Sensor:
1. Manufacturers:

a. ACI Part # A/AN-IM-4-PB or equivalent as submitted and accepted

O. S16 Secondary Loop Pipe-Mounted Immersion Temperature Sensor:
1. Manufacturers:
a. Equipment Provider as specified in Division 23.

P. S17 Outdoor Mounted Combination Temperature/Humidity Sensor:
1. Manufacturers:
a. ACI Part # A/RH2-AN-O or equivalent as submitted and accepted

Q. S18 Outdoor Mounted Pressure Port:
1. Manufacturers:
a. ACI Part # A/O-PUP-V or equivalent as submitted and accepted

R. S19 Panel-Mounted High-Limit Controller:
1. Manufacturers:
a. ACI Tekmar SP150, NO EXCEPTIONS

S. S20 Pipe-Mounted Flow Switch
1. Manufacturers:
a. Equipment Provider as specified in Division 13.

T. S21 Wall-Mounted 90-Minute Timer with Display
1. Manufacturers:
a. Wattstopper Part #TS-400-24-B, or equivalent as submitted and accepted

PART 3 EXECUTION

3.01 PREPARATION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. These specifications call out certain duties of the Contractor and any subcontractor. They are not intended as a material list of all items required by the Contract.

3.02 INSTALLATION

A. Device in-wall installation coordination requirements:
1. No sensors shall be installed on feature walls.
2. Do not mount behind Gym wall padding. Locate minimum of 6” above to of padding.
3. Do not mount behind Studio wall mirrors. Create RFI to relocate..
4. Do not mount behind wall wood paneling. Create RFI to relocate.
5. Do not mount behind wall tile. Create RFI to relocate.
6. Do not mount in exterior walls. If required, caulk all seams, including mud-ring to drywall.
7. Provide additional insulation behind yoga studio boxes to avoid leakage from non-heated spaces affecting sensor readings.
8. Do not mount inside CMU walls.
9. Verify ADA compliance for Massage, Infants, Mother’s, and Group Fitness.
10. Verify 60” above finished floor for all others except rooms with wall padding and Natatorium.
11. Coordinate height and spacing requirements with division 26 installed devices. When mounting adjacent to other devices, match height and spacing.
12. Space pressure sensing ports are mounted in ceiling tiles.
13. Occupancy sensors are mounted in ceiling tiles.

B. Utilize licensed installers and comply with Division 26 electrical specifications.

C. Provide related items and work indicated on the DI drawings and items and work called for in this Division of the Specifications. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start up, configuration, programming and commissioning coordination on each control product and system to provide fully operable systems in accordance with the specified functional performance.

D. Installation shall be in accordance with manufacturer's published recommendations and shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

E. The DI drawings show the general arrangement of the respective systems. Follow these Drawings as closely as actual building construction and the work of other trades will permit. Provide devices, power, fittings, sensors, controllers, wiring and accessories, which may be required but are not shown on the Drawings or specified herein. The Contractor shall be responsible for achieving the sequence of operations and intent of the system design.

F. All installation shall be in accordance with manufacturer's published recommendations.

G. Limit LAN cable lengths to no longer than 80% of the longest dimension published by the manufacturer of the cable between the most remote network nodes.

H. Comply with all rules, guidelines and procedures defined by the Owner's IT authority.

END OF SECTION

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SECTION 25 90 00
BAS - SEQUENCE OF OPERATIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes sequence of operations for whole facility automation, including subsystems and equipment.

1.02 RELATED DOCUMENTS

A. Section 23 09 34 - VARIABLE FREQUENCY DRIVES

B. Section 25 10 00 - BAS NETWORK SYSTEMS

C. Section 25 20 00 - BAS INSTRUMENTATION

1.03 REFERENCE STANDARDS

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

1.04 DEFINITIONS

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

1.05 SCOPE OF WORK

A. Refer to Section 25 10 00 - BAS NETWORK SYSTEMS.

PART 2 SEQUENCES

2.01 HEATING WATER SYSTEM

A. Modulating-Cascading Boiler (B-1, B-2, B-3):
   1. The boilers internal burners shall be controlled by the factory installed Master Boiler Controller (MBC).
   2. The MBC shall energize and modulate the Master Boiler between 20% to 100% fire-rate to maintain the supply water temperature at setpoint (150°F).
   3. If the Master Boiler is unable to maintain the setpoint while firing at 95% for 10 minutes (adj.), the MBC shall energize and modulate the secondary boiler between 20% and 100% fire-rate to maintain the setpoint.
   4. This cascade shall continue for however many boilers are in the plant.
   5. As demand decreases, the staging shall be reversed.
   6. As boilers stage on/off the boiler isolation valve shall open and close.
   7. As multiple boilers turn on, boilers shall match fire rate and modulate up/down together.

B. Heating Water Reset:
   1. Heating water supply temperature shall reset based on an outside air schedule.
   2. At 20°F (adj.) outside air the heating water supply temperature shall be 150°F (adj.).
   3. At 50°F (adj.) outside air the heating water supply temperature shall be 130°F (adj.).

C. Boiler Loop Pump (P-1, P-2):
   1. The lead pump will operate continuously.
   2. If the lead pump fails to start or fails while running, the BAS shall switch to the lag pump and indicate an alarm on the BAS.
   3. If the lead pump is not maintaining system differential pressure then the lag pump shall turn on and both pumps shall turn on to 50% speed. These shall modulate up as required to maintain differential pressure setpoint.
   4. If both pumps fail, the BAS shall alarm, and boiler shall turn off.

5. A system differential pressure sensor shall control the pump VFD to maintain system differential pressure at setpoint.
6. The BAS shall modulate the minimum flow bypass valve to maintain system pressure when boiler pump VFDs are at minimum speed.
7. The lead boiler pump shall rotate based on a run time of 200 hours (adj.).

D. Pool Heat Exchangers (HX-1,2)
1. Modulate heat exchanger control valve to maintain pool return water temperature at setpoint.
2. Flow Switch Safety: Wire switch back to control valve signal and open circuit when switch is open.

E. Warm Spa Heat Exchangers (HX-3)
1. Modulate heat exchanger control valve to maintain pool return water temperature at setpoint.
2. High Limit Temperature Controller shall shunt control signal valve actuator.
3. Flow Switch Safety: Wire switch back to control valve signal and open circuit when switch is open.
4. Control valve shall be fail closed style. No exceptions.

2.02 RADIANT SNOWMELT SYSTEM (HX-4, P-3, P-4)

A. The snowmelt system shall have automatic control with manual on, automatic, and standby/reset switch.

B. Precipitation and temperature sensors shall sense the surface conditions of pavement and shall be programmed to operate pump and heat exchanger control valves as follows:
1. Temperature Span: 34 to 44 deg F.
2. Adjustable Delay Off Span: 30 to 90 minutes.
3. Start Pump or Open Heat Exchanger Control Valve: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
4. Stop Pump or Close Heat Exchanger Control Valve: On detection of a dry surface plus time delay.

2.03 MAKEUP AIR UNIT (MAU-1

A. The makeup air unit is enabled by the Hood Control Panel and interlocked with the hood exhaust fan.

B. The makeup air unit shall automatically shut down in conjunction with fire detection or manual activation of Ansul system. Necessary interlocks shall be provided per Code.

C. Outdoor Air Damper:
1. Upon enable call from the Hood Control Panel, the outdoor air damper open, then the fan shall energize. Reverse sequence on call to disable unit from the Hood Control Panel.

D. DX Cooling:
1. The mechanical cooling shall operate to maintain the discharge air temperature at 10°F (adj.) above of room temperature setpoint in cooling mode per energy code.
2. Lockout: The mechanical cooling shall be locked out when the outside air temperature is less than 75°F (adj.).

E. Heating:
1. The gas-fired heating shall operate to maintain the discharge air temperature at 10°F (adj.) below room temperature setpoint in heating mode per energy code.

2. Lockout: The heating shall be locked out when the outside air temperature is greater than 65°F (adj.).

2.04 VAV TERMINAL UNIT

A. Heating:
   1. On a call for heat from the space sensor, the VAV Box dampers shall modulate to the minimum heating position and open/energize the heating coil. On a continued call for heat, the air volume damper shall modulate to the maximum heating damper position and the reheat coil shall modulate to maintain set point.
   2. ELECTRIC HEATING COIL Factory furnished SCR controller and digital thermostat shall modulate electric heat to maintain space set point.
      a. Minimum airflow during heating is 70 CFM/KW.

B. Cooling:
   1. On a call for cooling from the space sensor, the electric reheat coil shall be disabled and air volume damper shall modulate between the minimum position to the maximum position in order to maintain the room set point. In cooling mode, the VAV box shall close to minimum position if the inlet air temperature is higher than the room temperature set point in order to not overheat the room.

2.05 FAN COIL UNIT

A. Fan shall enable/disable from the BAS.

B. Zone Setpoint Adjust:
   1. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the local thermostat.

C. Fan: The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

D. Cooling:
   1. The cooling shall be enabled whenever:
      a. The fan is on.
      b. And the heating is not active.
   2. Heat Pump Unit: The zone thermostat shall measure the zone temperature, and the heat pump controller shall cycle the compressor to maintain its setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime. The compressor shall run subject to its own internal safeties and controls.

E. Heating:
   1. The heating shall be enabled whenever:
      a. The fan is on.
      b. And the cooling is not active.
   2. Heat Pump Unit: The zone thermostat shall measure the zone temperature, and the heat pump controller shall cycle the compressor to maintain its setpoint. To prevent short cycling, the stage shall have a user definable (adj.) minimum runtime. The compressor shall run subject to its own internal safeties and controls.

F. Drain Pan Overflow Switch:
   1. Upon overflow switch closing (sensing high water), stop fan and stop cooling and heating.

G. In the event of a space thermostat failure the fan shall be configured to run continuously.

2.06 EXHAUST FAN - SCHEDULED (EF-1,2,3,4,5,8,9,10,11)

A. Upon activation of building occupied mode, the motorized damper shall open and make contact with the end switch, and the fan shall energize. Reverse sequence on deactivation of building occupied mode.

2.07 EXHAUST FAN – CONTINUOUS OPERATION (EF-6,7)

A. Fan shall operate constant volume.

B. If the fan fails, an alarm shall initiate at the building automation system.

2.08 COLD SPA (CH-1)

A. The cold spa supply water temperature shall have a setpoint of 50°F (adj.) locally from the cold plunge controller.

B. The cold spa manufacturer provided controller shall modulate the condensing as required to maintain water temperature. When supply water temperature is satisfied the condensing unit shall turn off.

C. Building automation system shall monitor cold spa supply and return water temperatures via thermalwells.

2.09 MSAV - ROOFTOP PACKAGE UNIT (RTU-2-3,RTU-5-15)

A. Occupied Mode:
   1. The Supply Fan, Exhaust Fan, DX Cooling, Gas Heating, Economizer, Dehumidification, and Demand Controlled Ventilation: shall be enabled and operate per defined sequences below.

B. Unoccupied Mode:
   1. The Supply Fan, Exhaust Fan, DX Cooling, Gas Heating, Economizer, Dehumidification, and Demand Controlled Ventilation: shall be disabled.

C. Supply Fan:
   1. The Supply Fan speed shall be fixed to the required percentage of maximum setpoint for each of the following modes;
      a. DX Cooling Stage #1
      b. DX Cooling Stage #2
      c. DX Cooling Stage #3
      d. DX Cooling Stage #4
      e. Gas Heating Mode
      f. Ventilation Mode

D. Exhaust Fan:
   1. The Exhaust Fan shall be commanded to run when the Outside Air Damper position is greater than 50% open.

E. DX Cooling:
   1. The mechanical cooling shall stage compressors to maintain the space temperature at the Zone Cooling Setpoint.
   2. Lockout: The mechanical cooling shall be locked out when the outside air temperature is less than 45.0 °F (adj).

F. Heating:
   1. The gas-fired heating shall stage burners to maintain the space temperature at the Zone Heating Setpoint.

2. Lockout: The heating shall be locked out when the outside air temperature is greater than 45.0 °F (adj).

G. Economizer:
1. Outdoor air temperature, humidity and enthalpy shall be transmitted via NOAA to the building automation system which will input outside conditions to each unit.
2. The Economizer shall be active when the outdoor enthalpy is below the ODE Setpoint and there is a cooling demand. The Economizer shall modulate the outside air damper and return air damper to maintain the supply air temperature.
3. When not active, the Economizer shall modulate outside air damper the minimum position.

H. Dehumidification:
1. The Dehumidification shall be active when the Space Relative Humidity is greater than the Zone RH Setpoint. The compressors and hot-gas reheat shall be modulated to maintain supply air temperature.

I. Demand Control Ventilation (DCV):
1. The DCV shall modulate the outside air and return air dampers from minimum position to maximum position based on space carbon dioxide concentration.

2.10 VARIABLE AIR VOLUME - ROOFTOP PACKAGED UNIT (RTU-4)

A. Occupied Mode:
1. The Supply Fan, Exhaust Fan, DX Cooling, Gas Heating, Economizer, Dehumidification, and Demand Controlled Ventilation: shall be enabled and operate per defined sequences below.

B. Unoccupied Mode:
1. The Supply Fan, Exhaust Fan, DX Cooling, Gas Heating, Economizer, Dehumidification, and Demand Controlled Ventilation: shall be disabled.

C. Supply Fan:
1. The Supply Fan shall modulate to maintain the supply air static pressure at the Supply Air Static Pressure Setpoint.
2. Setpoint Reset:
a. The BAS shall monitor damper position of all VAV terminal units.
b. The initial duct static pressure setpoint shall be 1.00” w.c. (adj.) or the setpoint determined during test and balance to achieve VAV airflows.
c. When all zone dampers are throttling closed, below 85% open, the duct static pressure setpoint shall be incrementally reset down by 0.1” w.c. (adj.) at a frequency of 15 minutes to the minimum setting of 0.5” w.c. (adj.).
d. If more than 3 VAV terminal units (adj.) are at 100% open the reset sequence shall reverse and incrementally add 0.1” w.c. (adj.) every 15 minutes until the initial setpoint is reached.

D. Return Fan:
1. The Return Fan shall be commanded to run when the Outside Air Damper position is greater than 50% open.

E. DX Cooling:
1. The mechanical cooling shall stage compressors to maintain the supply air temperature at the Supply Air Temperature Setpoint.
2. Setpoint Reset:
a. The BAS shall monitor cooling demand of all VAV terminal units.
b. The DAT setpoint shall initially be 55°F (adj.).

c. When the cooling demand of 100% of zones (adj.) is satisfied, the DAT setpoint shall be incrementally reset up by 1°F (adj.) at a frequency of 15 minutes to the maximum setting of 65°F (adj.).
d. When 3 VAV terminal units (adj.) are above 90% damper position then the reset sequence shall reverse and incrementally subtract 1°F (adj.) every 15 minutes until the DAT reaches 55°F (adj.).

3. Lockout: The mechanical cooling shall be locked out when the outside air temperature is less than 45.0°F (adj).

F. Heating:
1. The gas-fired heating shall stage burners to maintain the supply air temperature at the Supply Air Temperature Setpoint.
2. Setpoint Reset: the setpoint shall be reset based on the sequence above.
3. Lockout: The heating shall be locked out when the outside air temperature is greater than 55.0 °F (adj).

G. Economizer:
1. Outdoor air temperature, humidity and enthalpy shall be transmitted via NOAA to the building automation system which will input outside conditions to each unit.
2. The Economizer shall be active when the outdoor enthalpy is below the ODE Setpoint and there is a cooling demand. The Economizer shall modulate the outside air damper and return air damper to maintain the mixed air temperature at the Mixed Air Temperature Setpoint (adj).
3. When not active, the Economizer shall modulate the outside air damper to the minimum position.

H. Dehumidification:
1. The Dehumidification shall be active when the Space Relative Humidity is greater than the Zone RH Setpoint. The compressors shall be modulated to maintain supply air temperature at the Supply Air Temperature Setpoint.
2. The Supply Air Temperature Setpoint shall be overridden to a value of two (2) °F below the current return air dew point. The override shall be released when the mode is not active.

I. Demand Control Ventilation (DCV):
1. The DCV shall modulate the outside air and return air dampers from minimum position to maximum position based on space carbon dioxide concentration.
2. Setpoint Reset: the setpoint shall be reset based on the sequence above.

2.11 YOGA STUDIO (RTU-1, EDC-1)

A. YOGA STUDIO MONITORING:
1. The BAS shall monitor the Studio temperature, humidity, radiant panel status and carbon dioxide concentration.
2. The Space Temperature Setpoint shall be adjustable from the local adjustable thermostat.
3. The setpoint shall be adjustable at 1 °F intervals.
4. The Heating Setpoint shall be equal to the Space Temperature Setpoint.
5. The Cooling Setpoint shall be equal to the Heating Setpoint plus the Cooling Offset.
6. The Cooling Offset shall be set to 4 °F.
7. The CO2 Setpoint shall be set to 1500 ppm.

B. VENTILATION MODE:
1. The Ventilation Mode shall be 50% of the design airflow rate.

2. The Ventilation Mode is active only when the RTU is not heating or cooling.

C. RTU ECONOMIZER MODE:
1. The Economoizer shall be active when the outdoor enthalpy is below the ODE Setpoint and there is a cooling demand. The Economizer shall modulate the outside air damper and return air damper to maintain supply air temperature.
2. When not active, the Economizer shall modulate the outside air damper to minimum position per the RTU schedule.

D. UNNOCUPIED MODE:
1. The Space Temperature setpoint shall reset to 78°F in Cooling Mode and 64°F in heating mode.
2. The RTU Economizer, DX Cooling, gas heating and DCV shall be enabled to maintain the studio at setpoint.

E. OCCUPIED MODE:
1. The Space Temperature shall be controlled to 75°F in Cooling Mode and 72°F in Heating Mode until local setpoint adjustment.
2. The RTU Economizer, DX cooling, gas heating and DCV shall be enabled to maintain the Studio at setpoint.
3. The radiant heat panels shall be activated with local adjustable 90-minute timer (Hot Yoga only).

F. HEATING COIL CONTROL:
1. The reheat coil (hydronic or electric) shall modulate when space temperature is above 80°F to maintain the duct discharge air temperature at the room space temperature setpoint.

2.12 EQUIPMENT SCHEDULING/SETPOINTS

A. Hours of Operation:
1. The schedules below are Life Time standard naming and hours of operation. If a club has non-standard spaces then the “custom” rows should be used for these schedules. All non-standard schedule groups should be reviewed and approved by Life Time Property Development and Operations.

SCHEDULE #	TYPE	SCHEDULE NAME	AREA SERVED	HOURS OF OPERATION	SCHEDULE BASIS
1	STANDARD	MAIN BUILDING	GYM, CARDIO, LOCKER ROOMS, ALPHA	4AM-MIDNIGHT	HOURS OF OPERATION
3	STANDARD	OFFICE	OFFICE/WORK	5AM-10PM	HOURS OF OPERATION
4	STANDARD	TENNIS	TENNIS	4AM-MIDNIGHT	HOURS OF OPERATION
5	STANDARD	CAFÉ	LIFE CAFÉ	5AM-10PM	HOURS OF OPERATION
6	STANDARD	SALON	LIFE SPA	5AM-10PM	HOURS OF OPERATION
7	STANDARD	CHILD CARE	KIDS ACADEMY	5AM-10PM	HOURS OF OPERATION &

					EXERP
8	**STANDARD**	**MECHANICAL**	**MECHANICAL AND LAUNDRY ROOM**	**4AM-10PM**	**HOURS OF OPERATION**
9	**STANDARD**	**STUDIO 1**	**STUDIO 1**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
10	**STANDARD**	**STUDIO 2**	**STUDIO 2**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
11	**STANDARD**	**STUDIO 3**	**STUDIO 3**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
12	**STANDARD**	**CYCLE**	**CYCLE STUDIO**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
13	**STANDARD**	**PILATES**	**PILATES STUDIO**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
14	**STANDARD**	**YOGA 1**	**YOGA STUDIO 1**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
16	**STANDARD**	**BARRE**	**BARRE**	**5AM-10PM**	**HOURS OF OPERATION & EXERP**
17	**STANDARD**	**CLINIC**	**CLINIC**	**5AM-10PM**	**HOURS OF OPERATION**
18	**STANDARD**	**ED CENTER**	**ED CENTER**	**5AM-10PM**	**HOURS OF OPERATION**
19	**CUSTOM**				
20	**CUSTOM**				
21	**CUSTOM**				
22	**CUSTOM**				
23	**CUSTOM**				

B. Temperature Setpoint Groups

1. The setpoints below are Life Time standard. If a club has non-standard spaces, then the “custom” rows should be used for these setpoints. All non-standard setpoint groups should be reviewed and approved by Life Time Property Development and Operations.

TEMPERATURE SETPOINT GROUP #	**TEMPERATURE SETPOINT GROUP NAME**	**APPLICABLE SPACES**	**OCCUPIED COOLING SETPOINT (ºF)**	**OCCUPIED HEATING SETPOINT (ºF)**	**UNOCCUPIED COOLING SETPOINT (ºF)**	**UNOCCUPIED HEATING SETPOINT (ºF)**	**RELATIVE HUMIDITY SETPOINT (%)**

1	**GENERAL**	**LOCKER ROOM** **CAFÉ/BAR** **OFFICES** **KIDS ACADEMY** **LAUNDRY**	**72**	**69**	**77**	**64**	**60**
2	**FITNESS FLOOR**	**CARDIO, WEIGHTS** **ALPHA** **GTX** **PT DESK** **GROUP FITNESS #1**	**71**	**68**	**76**	**64**	**60**
3	**MECHANICAL ROOMS**	**MECHANICAL ROOMS**	**78**	**64**	**78**	**64**	**60**
4	**BARRE**	**BARRE STUDIO**	**75**	**72**	**78**	**64**	**60**
5	**GROUP FITNESS #1**	**GROUP FITNESS #1**	**71**	**68**	**76**	**64**	**55** **(IF HARDWOOD)**
6	**GROUP FITNESS #2**	**GROUP FITNESS #2**	**71 (ADJUSTABLE THERMOSTAT)**	**68 (ADJUSTABLE THERMOSTAT)**	**78**	**64**	**55** **(IF HARDWOOD)**
7	**YOGA**	**YOGA 1** **YOGA 2**	**ADJUSTABLE THERMOSTAT**	**ADJUSTABLE THERMOSTAT**	**78**	**64**	**60**
8	**CYCLE**	**CYCLE**	**69**	**66**	**74**	**61**	**60**
9	**PILATES**	**PILATES**	**72**	**69**	**77**	**64**	**55** **(IF HARDWO**

							OD)
10	**DATA ROOMS**	**IDF/MDF**	**75**	**64**	**75**	**64**	**20-60**
11	**POOL**	**NATATORIUM**	**2 DEGREES ABOVE WARMEST BODY OF WATER**	**2 DEGREES ABOVE WARMEST BODY OF WATER**	**2 DEGREES ABOVE WARMEST BODY OF WATER**	**2 DEGREES ABOVE WARMEST BODY OF WATER**	**70**
12	**CUSTOM**						
13	**CUSTOM**						
14	**CUSTOM**						

PART 3 EXECUTION

3.01 REFER TO SECTION 25 10 00 - BAS NETWORK SYSTEMS.

END OF SECTION

SECTION 26 00 00
DIVISION 26 TABLE OF CONTENTS

DIVISION 26 – ELECTRICAL

26 05 00 - General Requirements
26 05 19 - Low-Voltage Electrical Power Conductors and Cables
26 05 26 - Grounding and Bonding for Electrical Systems
26 05 29 - Hangers and Supports for Electrical Systems
26 05 34 - Conduit for Electrical Systems
26 05 37 - Boxes for Electrical Systems
26 05 48 - Vibration and Seismic Controls for Electrical Systems
26 05 53 - Identification for Electrical Systems
26 05 73 - Power System Studies
26 05 83 - Wiring Connections
26 08 00 - Commissioning of Electrical Systems
26 09 23 - Lighting Control Devices
26 21 00 - Low-Voltage Electrical Service Entrance
26 27 26 - Wiring Devices
26 29 01 - Switchboards and Integrated Low-Voltage Distribution and Controls
26 51 00 - Interior Lighting
26 56 00 - Exterior Lighting

END OF SECTION

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SECTION 26 05 00
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 CONDITIONS

A. Each contractor involved in the electrical work or any Section of Division 26 for this project shall be governed by this Section 26 05 00 General Requirements in its entirety.

B. The General Conditions, Supplementary General Conditions and Division 1 General Requirements apply to Division 26.

1.02 SUMMARY OF WORK

A. The work to be done under this Specification and the accompanying drawings includes the furnishing of labor, materials, equipment and services necessary for the proper completion of electrical work. In general, this consists of wiring for light and power, installation of raceways for miscellaneous electrical systems and installation of lighting fixtures and other equipment hereinafter specified. Electrical work shall be complete with wiring, conduits, fittings, equipment and connections as specified or required.

B. The omission of express reference to any parts necessary for or reasonably incidental to a complete installation shall not be construed as releasing the contractor from furnishing such parts.

C. Electrical work drawings which include work of this specification division are indexed on the first sheet of the electrical and technology drawings.

D. Types of electrical related work specified in this section include the following:
   1. Access to electrical work:
      a. Access doors in walls, ceilings, and floors.
      b. Removable cover plates in walls, ceilings, and floors.
   2. Concrete for electrical work:
      a. Lean concrete backfill to support electrical work.
      b. Encasement of electrical work.
      c. Electrical equipment foundations and mounting pads.
      d. Rough grouting in and around electrical work.
      e. Patching concrete which has been cut to accommodate electrical work.
   3. Painting of electrical work:
      a. Where specifically noted to be painted.
   4. Quality control testing for concrete work is required as work of this section.

1.03 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in this Specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize himself with the existing conditions and limitations. No extra charges or extension in schedule will be allowed because of the contractor's misunderstanding as to the amount of work involved or lack of knowledge of any site conditions which may affect the work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum.

B. The existence of any wires, conduits, pipes, ducts, or other facilities are shown in a general way only. It will be the duty of the bidding contractors to visit the site and make exact determination of the existence of such facilities prior to the submission of bids. It is understood that the bidders will be responsible for making the exact determination of the location and condition of such facilities.

1.04 FEES, PERMITS, TAXES, AND INSPECTIONS

A. Regular inspections shall be requested by the contractor as required by regulations. Charges for the inspections by regulating agencies of installations or plans and specifications shall be paid by the contractor.

B. All permits, inspections and licenses shall be secured and paid for before actual work is started.

C. The contractor, after completion of work, shall furnish to the Owner a Certificate of Final Inspection and approval from the inspection bureau having jurisdiction.

D. State and Local Sales Tax. The Electrical Contractor shall include all state and local sales tax in the bid. The contractor shall maintain accurate records of all taxes and furnish such records to the Owner upon request.

1.05 QUALITY ASSURANCE

A. Manufacturers. Firms regularly engaged in manufacture of products for electrical work of sizes, types, ratings, and materials required, whose products have been in satisfactory use in similar service.

B. Installer’s qualifications. Firm with successful installation experience on projects with electrical related work similar to that required for this project.

C. Access units fire-resistance ratings. Where fire-resistance ratings are indicated for construction penetrated by access units, provide UL-listed and labeled units, except for units which are smaller than minimum size requiring ratings, as recognized by governing authority.

1.06 CODES AND STANDARDS

A. Contractor shall comply with all current ordinances, laws, regulations and codes applicable to the work involved. This does not relieve the contractor from furnishing and installing work shown or specified which may be beyond the requirements of such ordinances, laws, regulations and codes.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the Contract Documents, the most stringent shall govern. The contractor shall promptly notify the Engineer in writing of such difference.

C. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Contractor shall initiate, maintain, and supervise all safety pre-cautions required for his work including regulations of the Occupational Safety and Health Administration (OSHA).

E. UL Compliance. All equipment and systems specified in Division 26 shall comply with all applicable UL safety standards and have all required UL listings. All systems shall have UL-listed components, as well as a UL listing for the entire system. When a UL listing for the system is not available, the system shall be tested by an independent laboratory.

F. Concrete work. Comply with governing regulations.

1.07 DRAWINGS

A. The drawings are to scale as noted but the contractor shall refer to Architectural and structural Drawings for exact location of partitions, walls, beams, shafts, equipment, etc. Prior to rough-in, the contractor shall verify with Architect/Engineer exact location of all electrical devices, lights, poles, etc.

B. Each trade shall avail himself of drawings and specifications of all other trades and make an effort to coordinate his work with all other trades.

C. The contractor, before roughing-in facilities or installation of any equipment, shall consult all drawings, architectural, structural, mechanical, etc. for finishes, locations of ceiling, ceiling types, structural members, pipes, ducts, recessed lighting fixtures, conduits, etc., which may affect the installation. The contractor in installing his equipment shall leave adequate room for the installation of equipment by other contractors or subcontractors where space is limited.
   1. Consideration has been given to such condition of limited space in the preparation of the drawings and the locations and dimensions of equipment have been selected accordingly. The contractor shall be warned that in certain instances, space may be limited to the extent that there may be only one arrangement of equipment or facilities which will allow installation of same.
   2. Where connections are made to equipment furnished by others the contractor shall obtain exact location of connection from persons furnishing that equipment. The contractor shall confirm all voltage and wiring requirements prior to installation.

D. Discrepancies discovered before or after work has started, shall be brought to the attention of the Engineer immediately and the Engineer reserves the right to require minor changes in the work to eliminate such discrepancies with no change in contract cost.

E. The plans and specifications are complementary and what is called for in either one shall be as binding as if called for in both.

F. Where a disagreement exists in the plans and specifications, the item or arrangement of better quality, greater quantity or higher cost, shall be included.

1.08 SYMBOLS AND ABBREVIATIONS

A. Refer to Symbols and Abbreviations listed on drawings. Other symbols are in common usage but if uncertainty exists regarding plan symbols or abbreviations they shall be brought to the attention of the Engineer for clarification.

B. Where the phrase starts “Provide----,” “provide” shall be construed to mean the same as “Furnish and install-----“.

1.09 PRIOR APPROVALS

A. Prior Approvals. The acceptance of materials and equipment shall be based on the following conditions:
   1. The contractor shall adhere rigidly to the specifications and shall use exact equipment specified or an approved substitution. Where the words “or equal”, or similar, are used in the specifications, other manufacturers will be considered for acceptance as substitutions; however, such requests must be submitted by a bidding contractor for review prior to bidding. If the contractor desires tentative acceptance of a brand of merchandise not specified, sufficient data shall be submitted to the Engineer for appraisal 240 hours before the time set for bides to be received. If any manufacturer or brands other than those specified, are acceptable to the Engineer, the Engineer will indicate before bids are received; however, such acceptance must still be obtained as described in the following. Equipment which is not specified, or is not approved by addendum will not be considered.

1.10 PROJECT CONDITIONS

A. Existing utilities. Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Do not install electrical work to be above existing piping or be in the way of future excavation to existing piping. Where new electrical work must cross existing piping, cross at right angles, do not run parallel with piping.

B. Protect property from damage which might result from excavating and back-filling.

C. Protect persons from injury at excavations, by utilizing barricades, warnings, and illumination.

1.11 SHOP DRAWINGS

A. The quantity of Shop Drawings to be submitted shall be as noted in the General Conditions.

B. Shop Drawings shall be submitted by Specification section; all items in each section shall be one (1) bound submittal.

C. Shop Drawings shall be submitted electronically in PDF format. Utilize project document management site to post and manage submittals. Clearly mark all submittals with flags or highlights to indicate exact products and options being supplied.

D. Engineer will review initial submittal and one resubmittal. If shop drawings are required to be submitted more than two times dues to Contractor not submitting proper documentation or products, Engineer shall charge Contractor for more time spent reviewing the additional submittals.

E. Acceptance of certain items of equipment, designated by the Engineer, will be based on the manufacturer’s shop drawings and pamphlets which shall be submitted to the Engineer. The contractor shall be prepared to submit samples of equipment or material for appraisal when requested by the Engineer. No materials or equipment shall be installed until the Engineer has given acceptance in writing.

F. The contractor shall supply other trades with approved detail drawings of furnished equipment in the event that equipment will affect the work of other contractors.

1.12 COORDINATION

A. Coordinate work with other trades in the installation of equipment, piping, conduit, and ductwork.

B. HVAC/Sheetmetal Contractor shall initiate the coordination process by providing reproducible plan drawings showing ductwork.

C. Drawings will be forwarded to the Piping Contractor and Electrical Contractor for inclusion of their systems work.

D. Contractors shall solve all coordination conflicts among themselves when possible. The Engineer will arbitrate when necessary, and his judgment will stand, with no additional cost to the owner.

E. Refer to Section 01 31 01 - Project BIM Coordination for additional requirements for clash detection, including, but not limited to additional meetings, layout, and 3D CAD or Revit inputs for the coordination process.

1.13 TEMPORARY SERVICES

A. The Electrical Contractor shall carefully examine all parts of the General Requirements for requirements regarding temporary heat, temporary light, and other services. Contractor shall include in his bid an amount to cover his portion of such services.

1.14 INSTALLATION METHODS

A. The methods used for installation for electrical system and equipment shall conform to the National Electrical Contractors Association (NECA) published “Standard of Installation” except where specifically specified or shown otherwise.

B. Care shall be taken to rough-in outlet boxes, cabinets, etc., to provide a pleasing appearance. Center lines of outlets are to be aligned vertically or horizontally. Where outlets occur in wood panels, below windows, between doors and other such conditions of architectural features, the outlets shall be centered or otherwise located symmetrical with the major feature.

C. Panelboard and terminal cabinets where located adjacent to each other or one another, shall be same size and tops and bottoms shall be aligned.

D. Where factory-made precast panels are noted on the Architect’s drawings, the Electrical Contractor shall provide for in his bid, labor and materials for installation of junction boxes, cabinets, conduit, etc. within the precast panels. The Electrical Contractor will furnish and install all electrical items at the precast manufacturing plant as part of the fabrication process. Precast panels shall not be fabricated until the Electrical Contractor has given written approval that all required electrical items have been installed in precast panels. The Electrical Contractor shall furnish shop drawings (precast panel elevations) indicating all electrical rough-in locations for Engineer approval.

PART 2 PRODUCTS

2.01 ACCESS TO ELECTRICAL WORK

A. Access doors:
   1. General: Where floors, walls and ceilings must be penetrated for access to electrical work, provide types of access doors indicated, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer’s complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
   2. Access Door Construction: Except as otherwise indicated, fabricated wall/ceiling door units of welded steel construction with welds ground smooth; 16-gauge frames and 14-gauge flush panel doors; 175 swing with concealed spring hinges; flush screw-driver-operated cam locks; factory-applied rust-inhibitive prime-coat paint finish.

B. Removable access plates. Where switches, control devices, pull boxes and similar elements of electrical work are located within or behind walls, ceiling or floor construction of finishes, or below grade, and are not (cannot be) provided with integral removable access plates as specified in other Division 26 sections, provide removable access plates of types and sizes needed for access requirements, as indicated. Provide manufacturer' s complete units with anchorages, fasteners and standard factory-applied finishes.

2.02 PAINT

A. Material quality. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer’s identification as a standard, best-grade product will not be acceptable.
   1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

B. Color pigments. Pure, non-fading applicable types to suit substrates and service indicated.
   1. Lead content in pigment, NOT ALLOWED.

2.03 KEYING

A. The contractor shall furnish padlocks for each access door and switch operator having provision for padlocking.

B. Padlocks and locks in doors having built-in locks are to be Best or equal with interchangeable cores.

C. Padlocks and locks are to be keyed alike.

2.04 FIRE BARRIER SEALING SYSTEM

A. This contractor shall furnish all labor and materials needed to preserve the fire, smoke, and water containment integrity of the fire rated floors, walls and ceilings penetrated by electrical cables, raceway and ducts. Product shall be as specified in Division 7.

B. All fire barrier sealing systems shall be installed in accordance with manufacturer's instructions. Contractor is not to install the fire barrier material until all of the Owner's cables have been installed.

PART 3 EXECUTION

3.01 ACCESS TO ELECTRICAL WORK

A. Locate each removable access unit accurately in relation to electrical work requiring access.

B. Provide adequate temporary support or attachment to framing of form-work, that units will not be dislocated during construction of substrates.

3.02 PAINTING ELECTRICAL WORK

A. Surface Preparation:
   1. General. Clean surface before applying paint products. Remove oil and grease prior to mechanical cleaning. Comply with paint products manufacturer's instructions for surface cleaning and preparation. Remove surface-applied accessories which are not to be painted, and reinstall after completion of painting. Protect non-removable items not to be painted, by covering with paper or plastic film.
   2. Ferrous metal surfaces. Remove mill scale and loose rust on surfaces which are not zinc-coated or shop/factory prime coated. Each metal edge shall be filed or ground to eliminate sharp edges.
      a. Clean shop-applied prime coats on metal surfaces, and repair (touchup) prime coats wherever abraded or otherwise damaged, prior to application of paint system.
   3. Zinc-coated surfaces. Clean with non-petroleum based solvent. Wash with copper sulfate solution and flush with water, unless surface has been pretreated, or unless treatment is not recommended by manufacturer of prime coat.

3.03 PAINT SYSTEM APPLICATION

A. Mixing. Comply with manufacturer's recommendations for mixing or stirring paint products immediately before application.

B. General application requirements. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate, for type of material being applied, and for ambient conditions. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, or until paint film is of uniform finish, color and appearance.
   1. Apply paint at edges, corners, joints, welds, and exposed fasteners in manner which will ensure a dry-film thickness equal to that of flat surfaces. Allow sufficient time between successive coats for proper drying (comply with manufacturer's drying instructions).
   2. Number of coats. The number indicated is minimum number; apply as many coats as are necessary to comply with dry-film thickness requirements. Minimum thickness 0.002".

3. Coating thickness. Apply uniform coats to produce dry-film thickness indicated or, if not otherwise indicated, apply paint without thinning in application thickness recommended by manufacturer for each coat.
4. Smooth finishes. Except as otherwise indicated, apply paint in smooth finish without noticeable texture, cloudiness, spotting, holidays, laps, brush marks, runs, sags, ripples, ropiness, and other surface imperfections.

3.04 CUTTING AND PATCHING

A. This contractor shall perform all cutting and patching necessary in order to perform this work unless noted on drawings to be performed by the General Contractor; however, special permission shall be obtained from the engineer before cutting structural members or finished material. Patching shall be performed in such a manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by workers experienced, skilled, and licensed for the particular type of work involved. Inferior work will not be accepted. Holes in masonry shall be drilled by rotary drills. Impact tools shall not be used.

B. Prevent the spread of dust, debris and other material into adjacent areas.

3.05 HOLES THROUGH MASONRY

A. The Electrical Contractor shall provide all holes and openings required for electrical work unless such openings are shown on the Architectural and/or Structural drawings. The notes on structural drawings are particularly significant when precast and pre-stressed members are used.

B. Holes made in existing masonry for raceways or other electrical equipment shall be core drilled.

C. The contractor shall be responsible for grouting air-tight any openings adjacent to raceways etc. to seal against passage of air, smoke or vapors. Maintain ratings of fire rated partitions.

D. The contractor shall be responsible for providing and disposing of water used in the core drilling operation. Work shall be scheduled and coordinate with other trades so that damage will not result from the use of water.

E. The contractor shall install in each wall and floor sleeve opening fire rated material to maintain the fire rating of partition or floor.

3.06 CONCRETE BASES AND PADS

A. Concrete bases and pads for electrical equipment shall be provided by the electrical contractor. Provide concrete pads for all floor mounted and exterior grade mounted electrical equipment. Coordinate concrete pads for service MSA meter/mains and emergency generator with structural or manufacturer.

3.07 RECORD DRAWING NOTES

A. The contractor shall record all changes and deviations from the Contract Drawings. Refer to Division 1 for specific requirements. Include the following as a minimum:
   1. Record exact location and elevation of underground conduits, duct banks and direct burial wiring.
   2. Prepare Record Drawing changes for all electrical work within the building that occurs during the progress of construction. Include such changes as:
      a. Addenda
      b. Change orders
      c. Relocation of devices during construction
      d. Routing of feeder conduits, bus duct, and cable tray.
      e. Routing of exterior conduit

f. Final locations of motors, starters, disconnects, and controls
g. Revisions to over-current protection device quantity or arrangement in panelboards and switchboards.
h. Value engineering

B. The Record Drawings shall be maintained at the job site and be subject to review by the owner or architect/engineer during the construction period. This record keeping requirement shall not be construed as authorization for the contractor to make changes in the layout without definite instructions by the architect/engineer in each case.

C. At the completion of the project, one (1) set of Record Drawings shall be delivered to the Architect/Engineer. This work shall be completed and accepted by the Engineer before approval of final payment.

3.08 OPERATING AND MAINTENANCE MANUAL(S)

A. The contractor shall collect, gather and assemble manuals, each to contain the installation details, instructions, schematics of actual equipment and operations directions supplied by the manufacturer with equipment for the equipment and materials furnished under Division 26. Provide complete listing of suppliers and distributors where replacement parts or maintenance services are available. Manuals shall be submitted in 3-ring binder format and organized according to specification section. Label cover of manuals with project name; date of completion; and electrical contractor' s name, address, and telephone number. Final acceptance of the work will be withheld until such data has been presented complete to the engineer for transmission to the owner. The manual shall be prepared in time for engineer to review and for contractor to make corrections before owner instruction of operations and maintenance of equipment and systems is scheduled to begin. The manuals may be submitted as a PDF set in lieu of a paper set.

B. Manuals shall include, but not be limited to, the following:
1. Copies of final Shop Drawings
2. Copies of manufacturers’ warranties
3. Copies of all test results
4. Copies of all electrical inspector’s reports
5. Certificates of completion for all life safety equipment
6. Manufacturer’s operating instructions for equipment
7. Manufacturer’s wiring and installation instructions for equipment
8. Equipment parts list based on each specification section
9. Local equipment supplies/rep’s names, addresses, and telephone numbers
10. Equipment manufacturer's’ names, addresses, and telephone numbers
11. Subcontractors’ names, addresses, and telephone numbers
12. Refer to individual sections in Division 26 for additional requirements

C. Cross out or delete all information shown on Shop Drawings and other literature definitely not applying to this particular project and its equipment installed.

D. Manuals that do not meet the foregoing criteria will be rejected and returned to the contractor for resubmittal.

3.09 FINAL OBSERVATION

A. A final observation of the electrical systems by the Architect/Engineer will be conducted before the contract can be considered complete. The contractor shall inform the Engineer in writing when the electrical installation is complete and ready for final observation. The Engineer shall visit the project site and provide a list of items that need to be corrected or completed to achieve final completion. Should the Engineer attend the project to conduct the final observation and discovers that the work is not sufficiently complete to perform this task, then the contractor shall compensate the Engineer for his time. The contractor shall remain responsible for completing his work and requesting the Engineer to return for a final observation.

3.10 TESTS

A. The contractor shall test the equipment installed under this specification and shall demonstrate its proper operation to the engineer when requested by the engineer.

B. No equipment shall be tested, or operated for any purpose until it has been fully prepared, connected and made ready for normal operation. Damage to equipment occasioned by improper or ill-timed operation or testing shall be made good, at the contractor's expense, before final inspection and acceptance.

3.11 TRAINING

A. Contractor shall furnish, without additional expense to the owner, the services of competent instructions, who will give full instruction in the care, adjustment, and operation and maintenance of parts of the electrical equipment to the owner's permanent employees who are to have charge of the equipment. Provide a minimum of one man-week (40 hours) of instruction for electrical equipment. See individual sections for additional training requirements for special systems.

B. Each instructor shall be thoroughly familiar with all parts of the equipment on which instructions are to be given and shall be trained in operating theory as well as in practical operation and maintenance work. Factory trained instructors shall be employed where they are available. Instruction shall be given during regular work week and at a time just prior to the time the equipment is accepted and turned over to the owner for regular operation.

C. All training and operating instructions shall be audio and video recorded by the contractor and the recording media handed over to the owner.

D. Contractor shall submit to the Architect/Engineer, a letter, signed by the owner, stating that the instruction of operating personnel has been completed and is accepted by the owner.

3.12 MATERIAL AND WORKMANSHIP

A. All material and workmanship must be of the best throughout. Material and equipment must be new and must be adequately protected from damage and dirt. Each item or system shall be listed, inspected, and approved by a nationally recognized testing laboratory and shall bear a label indicating such. The Engineer reserves the right to reject material or workmanship not in accordance with the Specifications, either before or after installation. Contractor will be held responsible for defects in the material and workmanship which may appear during guarantee period after the building has been accepted. Such defects must be repaired or defective material replaced by the contractor at no expense to the owner. Exposed equipment, conduit, plates, panels, cabinets, etc. shall be installed square and true with building construction.

B. No asbestos, hazardous, or PCB containing materials of any type shall be used on this project.

C. The contractor shall be responsible for the proper installation of all systems in this contract and shall guarantee to remedy free of charge any defects in workmanship and materials for a period of 12 months from substantial completion.

3.13 WIRING METHODS AND HAZARDOUS AREAS

A. In locations exterior to the building, installation and equipment shall conform to NEMA 3R raintight standards.

B. In locations interior to the building, the installation and equipment shall conform to NEMA 1 standards, except as noted on the drawings.

C. In locations noted to be corrosive environments, the installation and equipment shall conform to NEMA 4X corrosion and extreme environment standards.

D. Where it is necessary to install sealing fittings accessible from rooms or areas which are finished, a flush wall or ceiling outlet box is to be installed and the conduit to be sealed run straight through the box with the sealing fitting occurring within the outlet box. The box shall then be covered with a blank plate.

3.14 AIR PLENUMS

A. Air plenums above suspended ceilings are being provided over certain portions of the building for use as a return air plenum in connection with the heating, ventilating, and air conditioning systems. All equipment and installations methods shall be approved for this type of space.

B. Insulated plenum spaces.
   1. The cold or warm perimeters of these plenums are being insulated and provided with insulation and a continuous, effective vapor barrier by the General Contractor where called for on the drawings.
   2. The air tightness and the effectiveness of the insulation and vapor barriers into construction to form air tight joints, or be provided with packed sleeves, are required for other piping.
   3. Where conduit enters these plenums, they must be firmly and tightly embedded into construction to form an air tight joint, or be provided with packed sleeves, as required for other piping.
   4. All boxes in conduit systems which can admit air to or release air from air plenums through connecting conduit systems, must be filled tightly with approved compound. All conduit in air plenums must be air tight.
   5. Where any conduit enter air plenums, extreme precautions must be taken to repair any damage done to insulation and interior vapor barrier, and interior vapor barrier must be tightly sealed to conduit, to ensure vapor tightness.

3.15 FINAL NAMES AND NUMBERS FOR ROOMS AND DOORS

A. Contractor shall note that names and numbers of rooms and doors on the architectural plans may not be the same as that selected by the owner for use in their final naming and/or numbering scheme. Contractor shall use final room names and numbering system as directed by the owner. This shall apply to all labeling, identification, and programming that is required by the Division 26 drawings and specifications.

3.16 CLOSEOUT ACTIVITIES

A. Refer to Division 1 specifications for closeout submittals and any demonstration and training requirements.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

E. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

F. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

G. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

J. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

K. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

L. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

Q. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

R. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

S. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

U. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Where not approved for use by the authority having jurisdiction.
      b. Where exposed to view, except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
      c. Where exposed to damage.
      d. For damp, wet, or corrosive locations.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

J. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted for service and panelboard feeder conductor sizes 1/0 AWG and larger.
      b. Aluminum conductors shall not be permitted for connection to mechanical equipment.
      c. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
         3) Provide aluminum equipment grounding conductor sized according to NFPA 70.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

K. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop. Notify Engineer if circuit will be longer than 210 feet.
3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop. Notify Engineer if circuit will be longer than 280 feet.
2. Class 1 Control Circuits: 14 AWG.
3. Class 2 Control Circuits: as per system manufacturer recommended size.

L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

M. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. 240/120 V, 1 Phase, 3 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.
d. Equipment Ground, All Systems: Green.
e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 12 AWG and Smaller: Solid.
      b. Size 10 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN/THWN-2.

E. Provide oversized neutral conductors where indicated or required.

F. Provide dedicated neutral conductor for each phase conductor for dedicated circuits, GFCI protected circuits, AFCI protected circuits, or where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor.

H. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
   3. Connectors for Aluminum Conductors: Use compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Aluminum Conductors: Use compression connectors for all connections.
7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
8. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 ACCESSORIES

A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant:
1. Listed and labeled as complying with UL 267.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as indicated.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is permitted where not otherwise prohibited, except for the following:
      a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
      b. Branch circuits fed from feed-through protection of GFI receptacles.
      c. Branch circuits with dimming controls.
      d. Branch circuits with isolated grounding conductor.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 6 inches (150 mm) of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Identify conductors and cables in accordance with Section 26 05 53.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

U. Unless specifically stated otherwise, or shown on drawings, all electrical cables and conductors shall be installed in raceway systems.

V. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Support and train all feeders within switchboards away from open bus bars and sharp metal edges within cabinets.

W. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

X. At minimum, use suitable wire pulling lubricant for building wire 4 AWG and larger. Use manufacturer-approved pulling compound or lubricant; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

Y. Protect exposed cables from damage.

Z. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

AA. Support cable according to Division 26 "Hangers and Supports for Electrical Systems".

BB. 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.

CC. Splices in conductors shall be made in outlet boxes, junction boxes, or approved wireways, only.

DD. Splices which are not fabricated with insulation device shall be taped with UL approved plastic electrical tape. Thickness of taped insulation shall be as thick as original insulation.

EE. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.

FF. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

GG. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

HH. Bolted splice connectors shall be filled with electrical insulation putty.

II. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.

JJ. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 36 - Cable Trays for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Rod Electrode(s):
    a. Provide single electrode unless otherwise indicated or required.
    b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
    c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
    b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for metal building frame where not used as a grounding electrode.
9. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
10. Provide redundant grounding and bonding for patient care areas in accordance with NFPA 70 and NFPA 99.

I. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
   2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
      a. Bonding Jumper Size: As indicated.
      b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
   4. Where rod lengths of greater than 10 feet (3.0 m) are indicated or otherwise required, sectionalized ground rods may be used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
   2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 05 50 00 - Metal Fabrications.

D. Section 26 05 34 - Conduit for Electrical Systems.

E. Section 26 05 36 - Cable Trays for Electrical Systems.

F. Section 26 05 37 - Boxes for Electrical Systems.

G. Section .

H. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field Welding: See Section 05 50 00.

D. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Applicable building code.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.

C. Materials for Metal Fabricated Supports: See Section 05 50 00.

D. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

E. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

F. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.

3. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 13/16 inch (21 mm) high.

G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2-inch (13 mm) diameter.
    b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
    c. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
    d. Outlet Boxes: 1/4-inch (6 mm) diameter.
    e. Luminaires: 1/4-inch (6 mm) diameter.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are permitted only as follows:
    a. Where approved by Architect.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Field Welding, Where Approved by Architect: See Section 05 50 00.

H. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches (80 mm) in height; see Section 03 30 00.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: See Section 26 05 34 for additional requirements.

J. Cable Tray Support and Attachment: See Section 26 05 36 for additional requirements.

K. Box Support and Attachment: See Section 26 05 37 for additional requirements.

L. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

Q. Install surface-mounted cabinets and panelboards with minimum of four anchors.

R. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.

S. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

T. Do not remove any fireproofing from building structure for support devices.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 34
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Galvanized steel electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Electrical nonmetallic tubing (ENT).
J. Liquidtight flexible nonmetallic conduit (LFNC).
K. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 07 84 00 - Firestopping.
D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
E. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
F. Section 26 05 29 - Hangers and Supports for Electrical Systems.
G. Section 26 05 37 - Boxes for Electrical Systems.
H. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

M. NEMA BI 50058 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

P. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

Q. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

R. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

S. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

Y. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Z. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

AA. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
   4. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit (RMC) elbows for bends.

D. Embedded Within Concrete:
   1. Within Slab on Grade(within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   2. Within Slab Above Ground(within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or electrical nonmetallic tubing (ENT).
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or electrical nonmetallic tubing (ENT).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
   5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
      b. Rigid PVC in pool equipment rooms is acceptable except across floors.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

M. Corrosive Locations: Use aluminum rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.

N. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), aluminum rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).

O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet (1.8 m).

P. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

C. Provide conduit, fittings, supports, and accessories required for complete raceway system.

D. Provide products listed, classified, and labeled as suitable for purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4-inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
   3. Control Circuits: 1/2-inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.
   5. Underground, Interior: 3/4-inch (21 mm) trade size.
   6. Underground, Exterior: 1-inch (27 mm) trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   2. Material: Use aluminum.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch (1.02 mm).

C. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch (0.05 mm).

D. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
   5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).
   6. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch (0.05 mm).

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.09 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA BI 50058 and listed and labeled as complying with UL 1653.

B. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings.
   3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.12 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.13 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

G. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

H. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

PART 3 EXECUTION

3.01 SUMMARY OF WORK

A. Unless specifically stated otherwise, wiring shall be installed in enclosed raceway systems. Raceways shall be sized in accordance with code for the conductors indicated. Where space will not permit the installation of one conduit of sufficient size to contain the conductors required, two or more conduits shall be provided. Raceway systems shall be complete from outlet to outlet and to cabinets and junction boxes and shall enter and be secured to boxes and cabinets in such a manner that the systems shall be electrically continuous from point of origin to all outlets.

B. Electrical Contractor is to furnish and install all wireways and raceways for audio/video, security, and data systems described in later specification sections and as shown on drawings. Where standard outlet boxes are required for installation of systems described in these sections, those outlet boxes shall be furnished and installed by the electrical contractor. Special rough-in and outlet boxes required for installation of systems described in these sections will be furnished by systems equipment manufacturer and shall be installed by electrical contractor. Each wireway and raceway system shall be complete with fittings, supports, etc. required for the rough-in ready installation of cable devices.

3.02 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Aluminum Rigid Metal Conduit (RMC): Install in accordance with NECA 102.

E. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

F. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

G. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

H. Electrical Nonmetallic Tubing (ENT): Install in accordance with NECA 111.

I. Liquidtight Flexible Nonmetallic Conduit (LFNC): Install in accordance with NECA 111.

J. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   13. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   14. Group parallel conduits in same area on common rack.

K. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is permitted only as follows:
    a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

L. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

M. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
10. PVC conduit runs below floors: Provide right metal conduit sweeps.

N. Underground Installation:
   1. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches (610 mm).
      b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
   2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.

O. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Maximum Conduit Size: 3/4-inch (21 mm) trade size unless otherwise approved.
   2. Install conduits within middle one third of slab thickness.
   3. Secure conduits to prevent floating or movement during pouring of concrete.

P. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 03 30 00.

Q. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

R. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where conduits enter building from underground.
      c. Where conduits may transport moisture to contact live parts.
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
      c. Where conduits penetrate coolers or freezers.
   3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.

S. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

T. Provide grounding and bonding; see Section 26 05 26.

U. It shall be the responsibility of this contractor to consult with the Mechanical Contractors before installing conduit or pull boxes for electrical feeders in order that any conflicts between the locations of raceway runs, piping and ductwork shall be avoided. Such locations shall be approved by the Engineer and shall in no case result in additional cost to the Owner.

V. Raceways shall not be mounted on equipment except where necessary to make connections to electrical devices which is part of, or mounted on, such equipment. Where raceways must be run on equipment, care shall be taken to not cover access doors, controls, removable panels, etc., or otherwise hinder the normal maintenance and repair of the equipment.

W. Identify conduits; see Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.05 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.06 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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SECTION 26 05 37
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes for hazardous (classified) locations.

D. Floor boxes.

E. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 07 84 00 - Firestopping.

C. Section 08 31 13 - Access Doors and Frames.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 34 - Conduit for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems

G. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
   4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
   5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   6. Use suitable concrete type boxes where flush-mounted in concrete.
   7. Use suitable masonry type boxes where flush-mounted in masonry walls.
   8. Use raised covers suitable for the type of wall construction and device configuration where required.
   9. Use shallow boxes where required by the type of wall construction.
   10. Do not use "through-wall" boxes designed for access from both sides of wall.
   11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
   14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   16. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: As indicated on plans.
      c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
   17. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 3R, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
   4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

E. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use nonmetallic, PVC, or epoxy coated floor boxes within slab on grade.
3. Use sheet-steel or nonmetallic floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.
   a. Flush Floor Outlets, duplex receptacle, round:
      1) Wiremold, devices and cover plates per drawings.
      2) Equivalent by prior approval only.
   b. Concealed service floor box:
      1) Wiremold, devices and cover plates per drawings.
      2) Equivalent by prior approval only.
6. See drawings for floor box requirements in each area.

F. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
4. Provide logo on cover to indicate type of service.
5. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify locations of floor boxes prior to rough-in.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 34.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.
   12. Electrical devices recessed in precast concrete walls: The electrical contractor is responsible for providing and coordinating all recessed electrical devices mounted in precast walls. The electrical contractor shall obtain a copy of the precast shop drawing submittal from the manufacturer and shall indicate all embedded electrical boxes and conduit on that submittal. A copy of the final submittal shall be submitted to the Engineer for review. See the architectural drawings for information on all walls constructed of precast concrete. Coordinate with manufacturer for installation of boxes into concrete forms at the precast fabrication plant.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

M. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

N. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 05 26.

T. Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Channel support systems.

B. Restraint cables.

C. Hanger rod stiffeners.

D. Anchorage bushings and washers.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. MFMA-4 - Metal Framing Standards Publication; 2004.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: D.
   2. Assigned Seismic Use Group or Risk Category as Defined in the IBC: III.
      a. Component Importance Factor: 1.25.
      b. Component Response Modification Factor: 4.0.
      c. Deflection Amplification Factor: 3.5.
   3. Seismic Design Category as Directed by the IBC: _____.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data:
   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 agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

2. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

C. Delegated-Design Submittal: For 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. 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.
   c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with NFPA 70.

C. Comply with applicable building code.

D. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, 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.

PART 2 PRODUCTS

2.01 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four (4) times the maximum seismic forces to which they will be subjected.

B. Channel Support System: MFMA-3, 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.

C. Trapeze System:
1. The hangers must be ASTM A36 all-thread rod.
2. The threads must be rolled form.
3. Pipes must be rigidly attached to the hanger rods.
4. Provisions must be made to avoid impact with the adjacent pipe, duct, equipment or building structure or to protect the pipe from such impact.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. 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.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. 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 anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install restrained isolators on electrical equipment.
   2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Hanging Conduit:
   1. Space lateral supports a maximum of 40' o.c. and longitudinal supports at 80' o.c.
   2. Brace a change of direction longer than 12'.
   3. Install restrained isolators on electrical equipment.
   4. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

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.

3.04 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 they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Tests and Inspections:

1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
2. Test at least four (4) of each type and size of installed anchors and fasteners selected by Architect.
3. Test to 90 percent of rated proof load of device.
4. Measure isolator restraint clearance.
5. Measure isolator deflection.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.07 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. IBC Table 13.6-1 Seismic Coefficients for Mechanical and Electrical Components.

Mechanical and Electrical Components	**Apa**	**Rpb**
Generator, batteries, inverters, motors, transformers and other electrical components constructed of high deformability materials	1.0	2.5
Motor control centers, panel boards, switch gear, instrumentation cabinets and others constructed of sheet metal framing	2.5	6.0
Lighting fixtures	1.0	1.5
Other mechanical or electrical components	1.0	1.5
Distribution Systems		
Electrical conduit, bus ducts, rigidly mounted cable trays and plumbing	1.0	2.5
Suspended cable trays	2.5	6.0

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. General Conditions, Supplementary Conditions and Division 01 apply to this section.

B. Section 09 91 00 - Painting.

C. Section 09 91 01 - Painting - Schedule.

D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

E. Section 26 05 73 - Power System Studies.

F. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

1.06 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Switchboards:
      1) Equipment name
      2) Identify ampere rating.
      3) Identify voltage and phase.
      4) Identify power source and circuit number. Include location when not within sight of equipment.
      5) Use identification nameplate to identify main overcurrent protective device.
      6) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   b. Motor Control Centers:
      1) Equipment name
      2) Identify ampere rating.
      3) Identify voltage and phase.
      4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   c. Panelboards:
      1) Equipment name
      2) Identify ampere rating.
      3) Identify voltage and phase.
      4) Identify power source and circuit number. Include location when not within sight of equipment.
      5) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      6) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      7) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   d. Transformers:
      1) Equipment name
      2) Identify kVA rating.
      3) Identify voltage and phase for primary and secondary.
      4) Identify power source and circuit number. Include location when not within sight of equipment.
      5) Identify load(s) served. Include location when not within sight of equipment.
   e. Enclosed switches, circuit breakers, and motor controllers:
      1) Identify power source and circuit number. Include location when not within sight of equipment.
      2) Identify load(s) served. Include location when not within sight of equipment.
   f. Electricity Meters:
      1) Identify load(s) metered.
2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:

a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
6. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Section 09 91 00.
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
   b. Motor control centers.
   c. Elevator control panels.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
   c. Service Equipment: Include the following information in accordance with NFPA 70.
      1) Nominal system voltage.
      2) Available fault current.
      3) Date label applied.
9. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
10. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. Within boxes when more than one circuit is present.

b. Within equipment enclosures when conductors and cables enter or leave the enclosure.

4. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:
1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
2. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
1. Use voltage markers or color coded boxes to identify systems other than normal power system.
a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 00 and 09 91 01 per the same color code used for raceways.
1) Fire Alarm System: Red.
b. For exposed boxes in public areas, do not color code.
2. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend:
a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
a. Equipment Designation: 1/2 inch (13 mm).
5. Color:
a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.
c. Fire Alarm System: White text on red background.

D. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
   2. Legend: Designation indicated and device zone or address.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch (5 mm).
   5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

B. Minimum Size:
   1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
   2. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

C. Legend:
   1. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

D. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility.

B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

C. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches (76 mm) wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
      a. Do not use labels designed to be completed using handwritten text.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Verify identity of each item before installing identification products.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

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SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems.

B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.

C. Section 26 29 01 - Integrated Low Voltage Distribution and Controls.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Engineer.

3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Study reports, stamped or sealed and signed by study preparer.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
         2) Utility Company: See Section 26 21 00 for Utility Company contact information.
      b. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
      c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      d. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
         2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
      e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
      f. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
   1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.
    b. Maximum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
    a. Identify date of study and study preparer.
    b. Identify study methodology and software product(s) used.
    c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    d. Identify base used for per unit values.
    e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    f. Include conclusions and recommendations.
2. Short-Circuit Study:
    a. For each scenario, identify at each bus location:
        1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
        2) Fault point X/R ratio.
        3) Associated equipment short circuit current ratings.
    b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
    a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
    b. For each graph include (where applicable):
        1) Partial single-line diagram identifying the portion of the system illustrated.

2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
3) Conductors: Damage curves.
4) Transformers: Inrush points and damage curves.
5) Motors: Full load current, starting curves, and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
a. For the worst case for each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
a. Include the following information:
1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Site-specific PPE (personnel protective equipment) requirements.
4) Nominal system voltage.
5) Limited approach boundary.
6) Restricted approach boundary.
7) Equipment identification.

8) Study preparer, report reference, and date calculations were performed.
9) Date label was applied to equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 77 00 - Closeout Procedures, for closeout submittals.

END OF SECTION

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SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 34 - Conduit for Electrical Systems.

D. Section 26 05 37 - Boxes for Electrical Systems.

E. Section 26 27 26 - Wiring Devices.

F. Section 26 29 01 - Integrated Low Voltage Distribution & Controls.

1.03 REFERENCE STANDARDS

A. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 29 01 and in individual equipment sections when included.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 34.

E. Wire and Cable: As specified in Section 26 05 19.

F. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

J. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

K. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Grounding and Bonding for Electrical Systems
   2. Cable Trays for Electrical Systems
   3. Underfloor Ducts
   4. Vibration and Seismic Controls for Electrical Systems
   5. Identification for Electrical Systems
   6. Electrical Utility Services
   7. Integrated Low Voltage Distribution & Controls
   8. Digital Lighting Control System
   9. Digital Power Monitoring System
   10. Interior Lighting
   11. Exterior Lighting

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section Includes:
   1. Digital Lighting Controls.
   2. Emergency Lighting Control.
   3. DMX Lighting Control.

B. Control Intent – Control Intent includes, but is not limited to:
   1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
   2. Initial sensor and switching zones.
   3. Initial time switch settings.
   4. Emergency lighting control.
   5. DMX programming and control.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 37 - Boxes for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems.

G. Section 26 27 26 - Wiring Devices.

H. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; Code of Federal Regulations; current edition.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

F. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

G. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

H. UL924 - Emergency Lighting and Power Equipment, Current Edition, including all revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0° to 40° C (32° to 104° F).

2. Relative humidity: Maximum 90 percent, non-condensing.

1.05 SUBMITTALS

A. See Section 01 33 00 submittal procedures and requirements.

B. Submittals Package: Submit the product data and shop drawings specified below at the same time as a package.
   1. Product Data: Catalog sheets including ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
      a. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
   2. Shop Drawings:
      a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
      b. Show exact location of all digital devices, including at minimum sensors, load controllers, and switches for each area.
      c. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   3. Include data for each device which:
      a. Indicates where sensor is proposed to be installed.
      b. Prove that the sensor is suitable for the proposed application.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Manufacturer: Minimum 10 years experience in manufacture of lighting controls.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 WARRANTY

A. Provide a five year limited manufacturer’s warranty on all room control devices and panels.

1.09 MAINTENANCE

A. Spare Parts:
   1. Provide spares of each product to be used for maintenance as listed below:
      a. Three (3) of each digital control device - room controllers, switches, occupancy sensors, daylight sensors.
      b. One (1) DMX controller.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL SYSTEM DESCRIPTION & OPERATION

A. The digital lighting control system as defined under this section covers the following equipment:
   1. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Digital Room Controllers – Self-configuring, addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.

3. Digital Occupancy Sensors – Self-configuring, addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
4. Digital Switches – Self-configuring, addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
5. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
6. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.

B. Emergency Lighting Control Unit (ELCU) – Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

C. DMX Controller - Programmable touch screen interface to allow for control of RGBW fixtures.

2.02 LIGHTING CONTROL APPLICATIONS

A. Unless relevant provisions of the applicable local energy codes are more stringent, provide a minimum application of lighting controls as indicated on the drawings.
1. Provide Manual-ON configuration for any enclosed office, class room, studio, or meeting room and Automatic-ON in the gymnasium, locker rooms, and any other rooms where hands-free operation is desirable.
2. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
   a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
   b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
   c. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn electric lighting back on at dimmed level, rather than turning full-on prior to dimming.

2.03 MANUFACTURERS

A. Acceptable Digital Lighting Controls Manufacturer:
1. Basis of design product: (Legrand) WattStopper Digital Lighting Management (DLM).
2. Subject to compliance with specified requirements of this section, one of the following:
   a. Lutron.
3. Substitutions: By prior approval.
4. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of ten working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
5. By using pre-approved substitution of basis of design system, the contractor accepts responsibility and associated costs for all required modifications to rough-ins, circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval by engineer prior to rough-in.

6. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

B. Acceptable DMX Control Manufacturer:
   1. Nicolaudie.
   2. Substitutions: Not allowed.

2.04 DLM LOCAL NETWORK (ROOM NETWORK)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

B. Features of the DLM local network include:
   1. Plug n' Go™ automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   2. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant testing, configuration or setup.
   3. Push n' Learn™ configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

D. If manufacturer's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

E. WattStopper Product Number: LMRJ series.

2.05 DIGITAL LOAD CONTROLLERS

A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
   1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
   3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.
   4. Device Status LEDs to indicate:
      a. Data transmission.

b. Device has power.
c. Status for each load.
d. Configuration status.

5. Quick installation features including:
   a. Standard junction box mounting.
   b. Quick low voltage connections using standard RJ-45 patch cable.
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100%.
   b. Turn off.
   c. Turn on to last level.
7. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off).
   b. Manual-on/Auto-off (Follow off only).
8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status.
   b. Electrical current (when available).
   c. Total watts per controller.
   d. Schedule state – normal or after-hours.
   e. Demand response enable and disable.
   f. Room occupancy status.
   g. Total room lighting and plug loads watts.
   h. Total room watts/sq ft.
   i. Force on/off all loads.
10. UL 2043 plenum rated.
11. Manual override and LED indication for each load.
12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
13. Zero cross circuitry for each load.
14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:
   1. One or two relay configuration.
   2. Efficient 150 mA switching power supply.
   3. Three RJ-45 DLM local network ports with integral strain relief and dust cover.
   4. WattStopper product numbers: LMRC-100 series.

C. On/Off/Dimming enhanced Room Controllers shall include:
   1. Real time current monitoring.
   2. Multiple relay configurations.
   3. Efficient 250 mA switching power supply.
   4. Four RJ-45 DLM local network ports with integral strain relief and dust cover.
   5. One dimming output per relay.

a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting.
b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads.
c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected driver.
d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
f. Calibration and trim levels must be set per output channel.
g. Devices that set calibration or trim levels per controller are not acceptable.
h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
8. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%.
   b. Set high and low trim for each load.
   c. Set lamp burn in time for each load up to 100 hours.
9. Override button for each load provides the following functions:
   a. Press and release for on/off control.
   b. Press and hold for dimming control.
10. WattStopper product numbers: LMRC series.

2.06 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Calibration and pushbutton configuration for the following variables:
      a. Sensitivity – 0-100% in 10% increments.
      b. Time delay – 1-30 minutes in 1 minute increments.
      c. Test mode – Five second time delay.
      d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
      e. Walk-through mode.
   2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   3. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.

b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
    1) Ultrasonic and Passive Infrared.
    2) Ultrasonic or Passive Infrared.
    3) Ultrasonic only.
    4) Passive Infrared only.
e. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. One or two RJ-45 port(s) for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld tool and control by remote personal controls.
6. Device Status LEDs, which may be disabled for selected applications, including:
    a. PIR detection.
    b. Ultrasonic detection.
    c. Configuration mode.
    d. Load binding.
7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8. Manual override of controlled loads.
9. All parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

C. BACnet object information shall be available for the following objects:
1. Detection state.
2. Occupancy sensor time delay.
3. Occupancy sensor sensitivity, PIR and Ultrasonic.

D. Units shall not have any dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC series.

G. Indoor Occupancy Sensors: refer to drawings for occupancy sensor types and locations.
1. Type DT: ceiling mount, dual technology, low voltage.
2. Type DT-B: ceiling mount, dual technology, low voltage. Black finish.
3. Type P: ceiling mount, PIR, low voltage.
4. Type P-EH: ceiling mount, PIR, low voltage, extended height lens.
5. Type P-ER: ceiling mount, PIR, low voltage, extended range lens.
6. Type U: ceiling mount, ultrasonic, low voltage.

H. Occupancy sensors in areas subject to damage (gymnasiums, tennis courts, pools, ball courts, and childcare gym and tumbling) shall be installed complete with wireguards.

2.07 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.

B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Calibration and pushbutton configuration for the following variables:
      a. Sensitivity – 0-100% in 10% increments.
      b. Time delay – 1-30 minutes in 1 minute increments.
      c. Test mode – Five second time delay.
      d. Detection technology – PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode.
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
         1) Ultrasonic and Passive Infrared.
         2) Ultrasonic or Passive Infrared.
         3) Ultrasonic only.
         4) Passive Infrared only.
   3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. Two RJ-45 ports for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
   6. Device Status LEDs including
      a. PIR detection.
      b. Ultrasonic detection.
      c. Configuration mode.
      d. Load binding.
   7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
   8. Assignment of local buttons to specific loads within the room without wiring or special tools.
   9. Manual override of controlled loads.
   10. All parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

C. BACnet object information shall be available for the following objects:
   1. Detection state.
   2. Occupancy sensor time delay.

3. Occupancy sensor sensitivity, PIR and Ultrasonic.
4. Button state.
5. Switch lock control.
6. Switch lock status.

D. Units shall not have any dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Top button:
   a. Press and release - Turn load on/off.
2. Bottom button:
   a. Press and hold left side - Lower dimming load.
   b. Press and hold right side - Raise dimming load.

G. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED.
   b. Dim locator level indicates power to switch.
   c. Bright status level indicates that load or scene is active.
2. The following button attributes may be changed or selected using a wireless configuration tool:
   a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
   b. Individual button function may be configured to Toggle, On only or Off only.
   c. Individual scenes may be locked to prevent unauthorized change.
   d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   e. Ramp rate may be adjusted for each dimmer switch.
   f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

H. Digital Wall Switch Occupancy Sensor: refer to drawings for switch types and locations.
1. Type A: Wattstopper LMDW series dual technology occupancy sensor with raise/lower buttons for control of dimmable loads.

2.08 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED.
   b. Dim locator level indicates power to switch.
   c. Bright status level indicates that load or scene is active.
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:

a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority.
b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
1. Button state.
2. Switch lock control.
3. Switch lock status.

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
1. Individual button function may be configured to Toggle, On only or Off only.
2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

F. WattStopper product numbers: LMSW series. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.
1. Refer to section 26 27 26 Wiring Devices for finish requirements.

G. Digital Wall Switches: refer to drawings for switch types and locations.
1. Type B: 5-button (4-scene plus off) scene switch.
2. Type L: switch for control of dimmable loads.
3. Type S: -button switch.

2.09 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.

B. Digital daylighting sensors shall include the following features:

1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level.
    b. Day and night setpoints.
    c. Off time delay.
    d. On and off setpoints.
    e. Up to three zone setpoints.
    f. Operating mode – on/off, bi-level, tri-level or dimming.
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials.
16. Any load or group of loads in the room can be assigned to a daylighting zone.
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Open loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).

2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
4. WattStopper Product Number: LMLS-500 series.

2.10 HANDHELD AND COMPUTER CONFIGURATION TOOLS

A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100.
1. Furnish one (1) and hand over to Life Time facility engineer during training.

2.11 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp rating.
2. Push to test button.
3. Auxiliary contact for remote test or fire alarm system interface.

B. Refer to drawings for emergency lighting control device types and locations:
1. Type S: switching relay.
a. LVS Controls Inc. Product Numbers: EPC-PM-120V, EPC-PM-277V.
2. Type D: dimming relay.
a. Where located in area where digital controls are not implemented:
1) LVS Controls Inc. Product Number: EPC-D-F.
b. Where located in area where digital controls are implemented:
1) WattStopper Product Numbers: ELCU-100, ELCU-200.

2.12 DMX CONTROL DEVICES

A. Touch sensitive controller with the following features:
   1. One (1) dedicated ON/OFF button.
   2. Eight (8) dedicated preset scene selector buttons.
   3. Two (2) dedicated buttons to allow for cycling between pages.
   4. Horizontal fader to adjust dimming level, color, and color fade speed.
   5. Clock and calendar integration.
   6. USB and ethernet connectivity for programming and control.
   7. RS232 and dry contact ports.
   8. Flexible programming options: PC, Mac, Android, iPad, or iPhone using included software.

B. Input Power: 6-9V DC.

C. Output Protocol: DMX512 (x2).

D. Device Color: Black.

E. Mounting: Single or double gang junction box.

F. Memory: microSD card, 4GB max, FAT16/32.

G. Programming Requirements: Each area where DMX control is indicated shall have unique scenes based on owner preference. Contact owner for .dlm files and upload to associated controller.

H. Additional Requirements: Utilize manufacturer's software to ensure certain controller functions are disabled based on owner preference. Contact owner for OPR document outlining desires and process.

I. Additional Materials: For each DMX controller, furnish one (1) additional SD card with .dlm file loaded. Cards to be labeled for appropriate area and handed over to Life Time facility engineer during system training.

J. DMX Controllers: refer to drawings for controller types and locations:
   1. Type X: Nicolaudie Stick-KE2.

PART 3 EXECUTION

3.01 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer’s representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
   1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
   2. Review the specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
   4. Discuss requirements for integration with other trades.

3.02 CONTRACTOR INSTALLATION AND SERVICES

A. Contractor to install all devices and wiring in accordance with NECA 1 (general workmanship). All line voltage connections to be tagged to indicate circuit and switched legs.

B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Low voltage wiring topology must comply with manufacturer' s specifications. Contractor shall route wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

C. Install the work of this section in accordance with manufacturer’s printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.

D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
   1. Adjust time delay so that controlled area remains lighted while occupied.

E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

F. Post start-up tuning - After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner' s requirements. Provide a detailed report to the Engineer of post start-up activity.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be turned over to the owner's personnel.

D. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 FACTORY SERVICES FOR DIGITAL LIGHTING CONTROLS

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.07 COMMISSIONING

A. A commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create any forms required for the commissioning process. The electrical contractor shall complete pre-functional checklists to ensure a smooth commissioning process.

B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent shall also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. The contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents, and does not affect project schedule.

END OF SECTION

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SECTION 26 21 00
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems:.

F. Section 26 29 01 - Switchboards and Integrated Low-Voltage Distribution and Controls.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.

B. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

C. Preinstallation Meeting: Convene 30 days prior to commencing work of this section to review service requirements and details with Utility Company representative.

D. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).

3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: Rocky Mountain Power.
   1. Point of Contact: Dustin Rudd.
   2. Phone: (801) 220-6209.
   3. Email: dustin.rudd@pacificorp.com.

D. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults and Pads: Provided by Contractor per Utility Company requirements.
      b. Transformers: Provided by Utility Company.
      c. Transformer Grounding Provisions: Provided by Contractor per Utility Company requirements.
      d. Primary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Provided by Contractor.
         3) Conductors: Provided by Utility Company.
      e. Secondary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Provided by Contractor.
         3) Conductors: Provided by Contractor (Service Point at transformer).
   2. Terminations at Service Point: Provided by Utility Company.
   3. Metering Provisions:
      a. Metering Transformer Cabinets: Provided by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

B. Verify that field measurements are as indicated on utility company drawings.

C. Verify that utility requirements for clearances are met.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment components in accordance with Section 26 05 29.

E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.

F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

G. Service connections shall be installed in strict accordance with the rules of the utility company. Electrical Contractor shall also be responsible for all negotiations with the utility company with regard to the service connections, and shall initiate the necessary requests to the utility company for the work which will be performed by the utility company.

H. This contractor shall pay all fees and charges submitted by the utility company for their part of the service installation and connections and shall perform all work required by the utility company to facilitate the complete installation of the service(s). No extra charges or extension in schedule will be allowed because of the failure of the contractor to contact the utility company and determine what will be required by the contractor in order to complete the service installation.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.
B. Wall-box occupancy sensors.
C. Receptacles.
D. Wall plates and covers.
E. Floor box service fittings.
F. Poke-through assemblies.
G. Overfloor raceways.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.
B. Section 09 30 00 - Tiling.
C. Section 09 51 13 - Acoustical Panel Ceilings.
D. Section 09 54 23 - Linear Metal Ceilings.
E. Section 09 72 00 - Wall Coverings.
F. Section 09 91 00 - Painting.
G. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
H. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
I. Section 26 05 37 - Boxes for Electrical Systems.
J. Section 26 05 53 - Identification for Electrical Systems.
K. Section 26 05 83 - Wiring Connections.
L. Section 26 09 23 - Lighting Control Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Shop Drawings: Include dimensioned layout with required components indicated for overfloor raceway.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.

C. Wiring Device Applications:
1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
2. Provide GFCI protection for:
a. Receptacles installed within 6 feet (1.8 m) of sinks.
b. Receptacles installed in kitchens.
3. Flush Floor Service Fittings in Tile Floors: Use tile rings.
4. Flush Floor Service Fittings in Carpeted Floors: Use carpet flanges.

D. Wiring Device Finishes:

1. Provide wiring device finishes as described below, unless otherwise indicated.
    a. Wiring devices installed in tile: Refer to specification section 09 30 00 - Tiling.
    b. Wiring devices installed in acoustical panel ceilings: Refer to specification section 09 51 13 - Acoustical Panel Ceilings.
    c. Wiring devices installed in linear metal ceilings: Refer to specification section 09 54 23 - Linear Metal Ceilings.
    d. Wiring devices installed in vinyl covered walls: Refer to specification section 09 72 00 - Wall Coverings.
    e. Wiring devices installed in painted walls: Refer to specification section 09 91 00 - Painting.
    f. Wiring devices installed in mirrors, granite, or slate, and in the kitchens, pool areas, and gymnasiums: Stainless steel faceplates with grey devices.
    g. Wiring devices installed in unpainted wood paneling or millwork: Brown devices and brown nylon coverplates.
    h. Wiring devices installed in unfinished areas: Galvanized steel faceplates with grey devices.
    i. Receptacles shutdown during fire alarm: Orange color.
2. Flush Floor Box Service Fittings: Refer to electrical drawings.

2.02 WALL SWITCHES

A. Manufacturers:
    1. Hubbell Incorporated: www.hubbell.com.
    2. Leviton Manufacturing Company, Inc: www.leviton.com.
    3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable FS W-S-896; types as indicated on the drawings.
    1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

E. Locking Maintained Contact Wall Switches: Low voltage maintained keyed switch mounted to switch plate by contractor. Key all switches alike.

2.03 WALL-BOX OCCUPANCY SENSORS

A. Wall-Switch Sensors (type OS on plans)
    1. Products: Subject to compliance with requirements, provide one of the following:
        a. Wattstopper, a brand of Legrand North America, Inc. #PW-301, set for manual ON operation.
        b. Approved equivalent.
    2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a major motion coverage area of 900 sq. ft.

2.04 RECEPTACLES

A. Manufacturers:
    1. Hubbell Incorporated: www.hubbell.com.

2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
5. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

F. Clock Hanger Receptacles: Single, 20A, 125V, NEMA 5-20R.

2.05 WALL PLATES AND COVERS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.

3. Lutron Electronics Company, Inc: www.lutron.com.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

F. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

G. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

H. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.

2.06 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.

B. Description: Service fittings compatible with floor boxes provided under Section 26 05 37 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: As indicated on plans.
b. Configuration: As indicated on plans.
2. Dual Service Flush Combination Outlets:
a. Cover: As indicated on plans.
b. Configuration:
1) Power: As indicated on plans.
2) Voice and Data Jacks: As indicated on plans.
3. Accessories:
a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.07 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
a. 2x2 series.
2. Thomas & Betts Corporation: www.tnb.com.
a. FPT3 series
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.

a. RC7 series.
4. As indicated on plans.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
1. Dual Service Flush Combination Outlets:
a. Cover: Slider access to power and data outlets.
b. Configuration:
1) Power: One standard convenience duplex receptacle(s).
2) Voice and Data Jacks: Refer to Division 27 specifications.
2. Accessories:
a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

2.08 OVERFLOOR RACEWAYS

A. Manufacturers:
1. Wiremold, a brand of Legrand North America, Inc[<>]: www.legrand.us.
a. OFR series.
2. Substitutions: not allowed.

B. Overfloor Raceway:
1. Description: Four-channel aluminum base with black powder coat finish, designed for installation directly to floor covering; furnished with removable tamper-resistant steel covers for installation of conductors and cables.
2. Routing and Required Components: As indicated on plans.
3. Components:
a. Base & Cover, #OFRBC-8.
b. Seam Clip, #OFR6.
c. Blank End Fitting, #OFR10B.
d. In-Wall Entrance End Fitting, #OFR10IW.
e. 4-Gang Box, #OFR48-4.
f. Crossover Kit, #OFR48-4GX.
g. Flat Elbow, #OFR11.
h. 45 Degree Flat Elbow, #OFR12.
i. Tee/Cross, #OFR15.
j. 3-Inch Poke-Thru Transition, #OFRPT3.
k. 4-Inch Poke-Thru Transition, #OFRPT4.
l. Coupling, #OFR1.
m. Grounding Clip, #OFR9.
n. Blank Device Plate, #OFR47-B.
o. Duplex Device Plate, #OFR47-D.
p. Communications Device Plate, #OFR47-2A.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.
   1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate unless otherwise indicated.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

K. Install wiring devices plumb and level with mounting yoke held rigidly in place.

L. Install wall switches with OFF position down.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Identify wiring devices in accordance with Section 26 05 53.

R. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

S. For overfloor raceways, install devices such that receptacles and low voltage outlets are mounted facing fitness equipment being served.

T. For fitness equipment receptacles, do not share neutral conductors or ground conductors across multiple circuits.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 29 01
SWITCHBOARDS AND INTEGRATED LOW-VOLTAGE DISTRIBUTION AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment purchased by Division 26 contractor from Integrated Panel Manufacturer.
   1. All equipment necessary for low voltage power distribution, motor control, centralized lighting control, and emergency egress lighting power.
   2. Includes: switchboards, panelboards, transformers, circuit breakers, lighting contactors, timeclock, photocell, motor controllers, emergency uninterruptible power supply, and loose disconnects.

1.02 RELATED REQUIREMENTS

A. Seismic Performance: Panelboards 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.
   2. Refer to Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems for seismic bracing requirements.

B. Section 01 40 00 - Quality Requirements.

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 34 - Conduit for Electrical Systems.

F. Section 26 05 37 - Boxes for Electrical Systems.

G. Section 26 05 73 - Power System Studies.

1.03 ABBREVIATIONS AND ACRONYMS

A. CPI: Carolina Products, Inc.

B. EPO: Emergency power off.

C. HOA: Hand/Off/Auto.

D. I/O: Input/Output.

E. IPM: Integrated Panel Manufacturer.

1.04 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. IEC 60947-1: General Applicable Rules for Standard utilizations Categories

C. IEC 60947-2: Circuit Breakers.

D. IEC 60947-3: Isolating Devices.

E. IEC 60947-4-1: Contactors and Motor Starters.

F. IEC 60947-5-1: Control and Signaling Units.

G. IEC 60947-6-2: Control and Protection Devices.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

I. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2006.

J. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See 01 33 00 - Submittal Procedures.

B. IPM shall prepare product data and shop drawings for Division 26 contractor and Engineer's review required.
   1. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, lighting inverters, overcurrent protective devices, and other installed components and accessories.
   2. Shop Drawings: for each type of switchgear, integrated panel, and related equipment.
      a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
      b. Provide wiring diagrams for power, signal, and control wiring clearly indicating factory wiring and required field wirings.
      c. Include documentation demonstrating selective coordination.

C. Operation and Maintenance data. Provide as specified under "Administrative Requirements" or under "Operation and Maintenance" section, whichever is more stringent.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with requirements of NFPA 70.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Electrical components, devices, and accessories shall be UL listed and approved, and final assemblies shall have a serialized UL label for entire enclosed assembly.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 COORDINATION

A. IPM to coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: CPI, contact Adam Worth: (704)-264-9029, adamw@cpipanels.com.

B. Alternate manufacturers will be considered with prior approval. Full design drawings indicating field and factory wiring requirements, control components used, component interlocks, and equipment room layouts showing all equipment footprints and clearances must be submitted as part of the approval process.

2.02 MANUFACTURED UNITS FOR POWER AND CONTROL DISTRIBUTION

A. Includes Square D Switchboard, overall service size and rated fault withstand current as indicated on the plans. Include customer demand metering as per the utility requirements.
   1. Selectivity: Where selectivity is required per specifications, furnish products as required to achieve selective coordination.
   2. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

B. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   2. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
         1) Provide thermal magnetic circuit breakers, unless otherwise indicated.
         2) Provide electronic trip circuit breakers for circuit breakers rated 800 A and larger and for all breakers serving emergency systems and elevators.
      b. Minimum Interrupting Capacity:
         1) 10,000 rms symmetrical amperes at 208 VAC.
         2) 14,000 rms symmetrical amperes at 480 VAC.
      c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
         1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 A and larger.
         2) Provide interchangeable trip units for circuit breaker frame sizes 225 A and larger.
      d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
         1) Provide the following field-adjustable trip response settings:
            (a) Long time pickup, adjustable by setting dial.
            (b) Long time delay.
            (c) Short time pickup and delay.
            (d) Instantaneous pickup.
            (e) Ground fault pickup and delay where ground fault protection is indicated.

C. Loose stepdown transformers with efficiencies as required per current standards and loose motor disconnects of size and fault current withstand as indicated on the plans.

D. Enclosure(s):
   1. Material: Bare Aluminum, NEMA 1 rated.
   2. Final Assembly shall bare a serialized UL 508 label.
   3. Size: As required per plans indicating locations, footprint limitations with power and controls functions as indicated.
   4. Panel front door shall be cut out to allow operation of all circuit breakers, hand switches and miscellaneous other devices without exposure to live components.
   5. Enclosure shall have an open bottom and closed top.
   6. Standard 84 in. height doors shall have at least 3 lift-out hinges and at least 2 quarter-turn, quick release, cam-lock fasteners opposite the hinge side for securing door closed.
   7. Spacing between internal mounted components shall, at minimum, meet the required clearances per NEC.
   8. Panels shall have separate lockable cover over each circuit breaker operator access panel.

E. Surface-mounted Pilot Lights, Push Buttons and Selector Switches:
   1. Physical Characteristics:
      a. Size: 30.5 mm.
      b. Rating: NEMA 1/4/12/13; IEC 529 IP66/65
   2. Pilot Lights:
      a. Power Source Modification: 120VAC or higher requires integral step-down transformer; Maximum voltage at the lamp: 24V.
      b. Lamp/bulb: LED high intensity -- easily recognized "on-state" under typical indoor room illumination levels.
      c. Colors: green = equipment "on/running"; red = "off"; orange/amber = "fault/failure".
   3. Push Buttons and Selector Switches:
      a. Contact Ratings:
         1) Utilization Categories: NEMA A600 / IEC AC-15
         2) 120 - 600Vac: 7200VA make; 720VA break.
         3) 72 -120Vac: 60A make; 720VA break
         4) 24 - 72Vac: 60A make; 10A break.
         5) Maximum continuous current: 10A(ac).
   4. Other Miscellaneous Surface-Mounted Devices
      a. Nameplates/Labels.
         1) Machine printed permanent black ink or engraved bi-layer phenolic plastic; black surface with white lettering.
         2) Protected from degradation due to accidental water splash.
         3) Text size: Major Equipment: 1/2"H, Small Devices 3/16"H.

F. Interior Mounted Components.
   1. All Panelboards.
      a. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
      b. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
         1) Altitude: Less than 6,600 feet (2,000 m).
         2) Ambient Temperature:
            (a) Panelboards containing Circuit Breakers: 32 - 104 F.
      c. Short Circuit Current Rating:

1) Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

d. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

e. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

f. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1) Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

g. Conductor Terminations: Suitable for use with the conductors to be installed.

h. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1) Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2) Boxes: Galvanized steel unless otherwise indicated.
(a) Provide wiring gutters sized to accommodate the conductors to be installed.
3) Fronts:
(a) Where mounted as assemblies inside an overall enclosure, provide open frame plus circuit breaker cover plate. Provide spacers to provide secure fit when assembly door is closed.
(b) Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

i. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

j. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1) Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2) Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
(a) Use zero sequence ground fault detection method unless otherwise indicated.
(b) Provide test panel and field-adjustable ground fault pick-up and delay settings.

k. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

l. Load centers are not acceptable.

2. Combination Motor Starters Conforming to IEC and UL508
a. Utilization category: AC-3.
b. Coordination required: Type 2.
c. Combination Motor Starter configuration (circuit breaker, contactor & overload) must be a UL listed combination for the Short Circuit Current Rating (SCCR) as shown on the plans. See Website: http://www.ul.com/global/eng/pages/offerings/industries/powerandcontrols/industrialcontrolequipment/shortcircuit/
d. Acceptable Manufacturers for Combination Motor Starters:
1) Square D TeSys for the North American Market; No Substitutions

3. Lighting Contactors

a. Utilization Category: AC-1.
b. Coordination required: Type 1.
c. Combination circuit breaker and contactor must be a UL listed combination for the Short Circuit Current Rating (SCCR) as shown on the plans. See Website: http://www.ul.com/global/eng/pages/offerings/industries/powerandcontrols/industrial control equipment/shortcircuit/
d. Acceptable Manufacturers for lighting assemblies: Square D TeSys for the North American Market; No Substitutions.

4. Small Size, 6-pulse Component Variable Frequency Drives (1/2 to 25 HP)
   a. Equipment Name(s)/Tagname(s): see schedules for information.
   b. Power Input Options: with 5% line choke, see schedules for information.
   c. Power Output Options: see schedules for information.
   d. Motor Size(s): see schedules for information.
   e. Output wiring from drive to motor: specific purpose shielded cable required, see "Low Voltage Electrical Power Conductors and Cables".
   f. VFD size selected for each application shall be based on the motor current as per NFPA 70, Table 430.250 or motor nameplate data, which ever is the greatest.
   g. Load carrying capacity: Continuous at 100% load, 150% for 60s (every 10 min), 180% for 2s (every 10 min).
   h. Output frequency: 0 to 120 Hz minimum.
   i. Output carrier frequency: programmable 5 to 10 kHz.
   j. Drive interface requirements:
      1) VFD shall contain the minimum built-in standard configurations to operate as described herein:
         (a) Drive output to motor shall be selectable to either V/Hz or Sensorless Vector scheme. V/Hz characteristic curve shall be adjustable.
         (b) The drive shall have an integral start/stop device, and speed control knob, such that a power interruption, and subsequent return to power, will cause the drive to restart automatically and ramp up to the speed setting set by the speed control knob, if in fact, it was previously operating at the time of power interruption. If the drive was off at the time of power interruption, it will remain off on return of power.
         (c) The drive shall have the minimum capabilities (via hardwired I/O) for remote start/stop and speed control, such that a power interruption, and subsequent return to power, will cause the drive to restart automatically and ramp up to the speed setting as determined by remote unpowered sources such as momentary start & stop push buttons and a potentiometer, if in fact, it was previously operating at the time of power interruption. If the drive was off at the time of power interruption, it will remain off on return of power.
         (d) The drive shall have all the functions as stated in above items "a & b" plus an Integral remote/local switch, such that a power interruption, and subsequent return to power, will cause the drive to restart in it's previous mode (local or remote) and ramp back up to speed based on the previous setting (local or remote).
         (e) When the drive has a fault, a dry relay contact shall close for remote indication of status and be capable of at least 120Vac at 2A resistive.
         (f) If the drive fails to start, provide configurable parameter for number of retries before setting the "fault" status.

(g) The drive shall have an embedded PID function and the I/O to provide such functions as remote (and local) start/stop and HOA hardwired switches and speed control based on a process set point.
(h) The drive shall contain communications interconnection and sufficient I/O whereby the following minimum features can be viewed and controlled via local, remote hardwired and remote communications.
(i) Communications protocol required: RS485 (modbus RTU), Ethernet/IP, or DeviceNet. NOTE: if a particular manufacturer cannot the communications protocol specified, the manufacturer may submit on the next best drive line that can supply this protocol or provide the necessary adapter, plus power required to that adapter and an enclosure that meets the rating where the drive will be installed.

2) Hardwired I/O:
(a) Analog Input(s): 2 - configurable/programmable unipolar either 0-10Vdc or 4-20mA.
(b) Analog Output(s): 1 - configurable/programmable.
(c) Digital Input(s): 3 - as sensed by remote dry contacts
(d) Digital Output(s): 1 - dry contact for indication of : ready/fault status. Minimum contact rating of switching voltage up to 120Vac and minimum resistive current of 2A.

3) Minimum Operational Programmable Features:
(a) Current limit: 0 - 200%.
(b) Overload Class Protection: Class 10.
(c) Acceleration Time.
(d) Deceleration Time.
(e) All inputs' and outputs' functions and configurations.

4) Operator Interface: at minimum integral one line LCD display with membrane buttons for navigation, start/stop and speed control capable of being mounted remotely from the drive, up to 15', and be capable of uploading the drive's configuration parameters to be downloaded to another.

k. Ambient Environment
1) Operating temperature: 0 to 40°C (32 to 104°F), no frost, non-condensing.
2) Location: Indoors exposed.
3) Required drive enclosure rating: IP20/ NEMA/UL Type 0. NOTE: if a particular manufacturer cannot meet the enclosure rating required, this manufacturer shall provide an enclosure which can meet the requirement, and in addition, provide a cooling system so that the drive can function in the ambient environment specified.
4) Physical Mounting: wall mount.
5) Public Exposure: limited access to unskilled operators.

l. Acceptable Manufacturers
1) Square D Altivar 312 series.
2) No Substitutions.

5. VFD Input Line Reactors
a. Designed for specifically for harmonic filtering service.
b. Maximum Operating Temperature: 40 C.
c. Ambient Humidity operating limits: 0 - 95% non-condensing.
d. Impedance: 5%
e. Basic Construction: copper wire wound on magnetic steel core.

1) Copper windings shall be wire or foil.
2) Core shall be constructed of laminated, grain-oriented, magnetic steel; grade M6 or better.

f. Assembly
1) Completed inductors shall be double-impregnated using 100% solid epoxy resin.
2) All insulation varnish systems shall be rated Class H, 600V.
3) Inductors shall be air-gapped to avoid control point saturation.

g. Quality Assurance
1) Inductors shall be Hi-Potential tested (at 2,500 V, 60 Hz) for one minute both all line-to-line and line-to-ground connections.
2) UL component-recognized and built to comply with UL508A standards.

h. Acceptable Manufacturers
1) Trans-coil Inc. KDR or KLR series.
2) MTE RL-Line Load Reactors.
3) Or Equal.

6. Programmable Logic Controller (PLC) System
a. PLC Assembly shall have at least one analog input and multiple dry contact relay outputs to accept a photocell input and energize corresponding outputs depending on daylight intensity. At minimum, programming shall include operator adjustable set points for each relay output determined by daylight intensity on a scale 0 to 10.
b. At minimum, analog input(s) shall accept +/-10Vdc signal with a minimum impedance of 100kΩ and are allowed to share a common (single-ended). Resolution shall be -32,000 to +32,000.
c. At minimum analog output(s) shall be configurable as 0-10V into impedance >= 5kΩ or 0-20mA into 500 Ω maximum load.
d. Digital inputs shall be field configurable as sinking or sourcing, 24 Vdc maximum supply voltage.
e. Digital outputs shall be dry contact relay type capable of switch voltage of from 5 to 30Vdc or 5 to 250Vac at 2.0A maximum. Up to 4 dry contacts are allowed to be on one common return/neutral; total common current not to exceed 10A.
f. PLC System shall be able to control an additional 7- I/O modules within a limited power budget depending on types of expansion modules used. Control panel layout shall leave at least 12" for future I/O module installations.
g. The PLC shall also provide at least 2 digital communication ports; one for an Electronic Operator Interface (EOI) and one for connection to a PC/laptop for maintenance, programming and troubleshooting.
h. PLC system shall have a modem connection to a standard analog telephone line for remote troubleshooting and maintenance.
i. Electronic Operator Interface (EOI) shall be included and programmed to perform basic operator input and status of controlled equipment. EOI may be monochrome, and be at least 5.5" diagonal size.
j. Entire system as described herein shall be a single source manufacturer and shall be a Siemens Simatic S7-200 series with compatible expansion modules, modem and EOI as described herein.

2.03 REMOTE HOA PANEL

A. Manufacturer: IPM.

B. Refer to drawings for enclosure quantity, location(s), and control information.

C. Enclosure:
   1. Size: 16"x16"x6" or as required per plans indicating location, footprint limitiations with power and control functions as indicated.
   2. Material: NEMA 4X construction.
   3. Door Latches: non-metallic except for hasp and pin which are to be 316L stainless steel.

D. Door-mounted Components:
   1. Push Buttons and Selector Switches:
      a. 22mm hand/off/auto switches in quantity required for control of pool pumps.
         1) Hand position bypasses control and runs continuously.
         2) Auto position runs based on control status only.
      b. 120V maintained switch positions.
   2. Pilot Lights:
      a. Voltage: 120V pilot light to indicate operation.
      b. Colors:
         1) Green: Equipment on/running.
         2) Red: Equipment off.
         3) Orange/Amber: Fault/failure.
   3. Internal Components:
      a. Terminal strips for field connections between HOA panel and associated integrated panel.

2.04 STEAM GENERATOR CONTROL PANEL

A. Manufacturer: IPM.

B. Refer to drawings for enclosure quantity, location(s), and control information.

C. Enclosure:
   1. Size: 18"x18"x6" or as required per plans indicating location, footprint limitiations with power and control functions as indicated.
   2. Material:
      a. Non-Corrosive Environments: bare aluminum NEMA 1 construction.
      b. Corrosive Environments: 16"x16"x6" NEMA 4X construction.

D. Internal Components:
   1. Honeywell thermostat programmed by IPM for dual setpoint temperature control.
      a. Setpoint 1 for solenoid 1: 115 degrees Fahrenheit interlocked with eucalyptus pump.
      b. Setpoint 2 for solenoid 2: 110 degrees Fahrenheit.
   2. Time delay relay programmed by IPM for 15-minute steam demand.
   3. QOU115 circuit breaker for 120V control power.
   4. Terminal strip for field connection of steam generator solenoids, temperature sensor, and pushbutton for steam demand.

E. Loose Components for Field Installation:
   1. Normally closed maintained contact EPO for emergency shutdown of steam generator. Refer to drawings for quantity, location(s), and model number specification.
   2. Normally open momentary contact pushbutton for steam demand. Refer to drawings for quantity and location(s).

2.05 EMERGENCY UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Description: NFPA 111 Type A, Class 1.5 stored emergency power supply system designed for Level 1 applications and consisting of rectifier/charger unit, storage battery, and solid state inverter with mechanical transfer switch, in one or several enclosures. Provide unit suitable for operating LED lamps without extinguishing lamp on transfer.

B. Ratings: As indicated on the drawings. Unit shall be capable of supplying 100% of the indicated kVA, at 1.0 power factor, for 90 minutes.

2.06 POWER MONITORING EQUIPMENT

A. Customer meter to be as specified on plans, furnished factory installed in MSB as part of the IPM package, meter wiring by Division 26 contractor.

PART 3 EXECUTION

3.01 PREPARATION

A. Protection from in-place conditions until startup.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Control Wiring Installation:
   1. Wiring Method: Install all wiring in raceway as specified in 26 05 34 and 26 05 37, unless run in accessible ceiling space.
   2. Bundle, train, and support wiring in enclosures.
   3. Ground equipment.

3.03 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to set up test, adjust, and program dimming controls.

B. Schedule visual and mechanical inspections and electrical tests with at least seven days advanced notice.

C. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the contract documents.

D. Check tightness of electrical connections with torque wrench calibrated within the previous 6 months. Use manufacturer's recommended torque values.

E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
   1. Continuity tests of circuits.
   2. Operational Tests: 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 timing control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

F. Correct deficiencies, make adjustments, and retest. Verify that specified requirements are met.

G. Test labeling: After satisfactory completion of tests and inspection, apply a label to tested components indicating test results, date, and responsible agency and representative.

H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.04 CLEANING

A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by the manufacturers, and repair damaged finishes.

3.05 DEMONSTRATION

A. Coordinate training for low-voltage, programmable lighting systems.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of two four-hour sessions on separate days for training. Use both classroom training and hands-on exercises.
   2. Training Aid: User the approved final version of the maintenance manual as a training aid.
   3. Schedule training with the Owner, through Architect, with at least seven days advance notice.

3.06 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Record basic parameter setup and set points required to operate the drive correctly.

END OF SECTION

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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. LED drivers.

E. Lamps.

F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section .

B. Section 26 05 37 - Boxes for Electrical Systems.

C. Section .

D. Section 26 05 53 - Identification for Electrical Systems.

E. Section 26 09 23 - Lighting Control Devices.

F. Section 26 27 26 - Wiring Devices.

G. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. State Approval:
   1. Where required, fixtures shall be listed and approved by the state of California.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Failure to promptly submit shop drawings per this specification for scheduling purposes shall not be an acceptable reason for substitution.

C. Submit in booklet form with separate sheets for each fixture, assembled in alphabetical order, and labeled by luminaire type as indicated on drawings.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   3. Submit dimensioned drawings for linear type suspended fixtures indicating suspension points and feed points, extrusion lengths and lamping. Include wiring diagrams to indicate switching, dimming, and emergency wiring arrangements.
   4. Shop drawings for custom fixtures shall be accurately drawn and dimensioned to indicate all critical design elements of the fixture, including wiring, ballasts (if required), and mounting information.
   5. Provide photometric calculations where luminaires are proposed for substitution upon submittal.

E. Samples:
   1. Provide one sample of each specified luminaire where indicated.
   2. Provide one sample of each custom luminaire upon request.
   3. Provide one sample of each luminaire proposed for substitution upon request.
   4. Provide one sample(s of each product finish illustrating color and texture upon request.

F. Field quality control reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

C. Provide five year full warranty for batteries for emergency lighting units.

D. Provide five year full warranty for batteries for fixture emergency lighting units.

E. Provide five year full warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Basis-of-Design Product: The design for each light fixture is based on the product named.

C. Substitutions: By prior approval.

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of ten working days prior to the bid date and must be made available to all bidders.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
4. References to SSL and/or LED sources shall include the entire solid-state lighting system, including circuitry, LEDs, power supplies, drivers, etc.
5. CRI and color temperature as scheduled in accordance with ANSI C78.377.
6. NEMA.SSL-1 compliant for operational characteristics and electrical safety of SSL power supplies and drivers. ANSI/NEMA C82.77 compliant for maximum allowable harmonic distortion produced by SSL power supplies.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
1. LED Tape - General Requirements:
a. Listed.
b. Designed for field cutting in accordance with listing.

J. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.

4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.
   3. Housings for edge-lit style exit lights shall be recess mounted.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
   1. Self-Powered Exit Signs:
      a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
      b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
      c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
      d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
      e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

C. Self-Luminous Exit Signs: Internally illuminated by tritium gas sealed inside phosphor-lined gas tubes, requiring no electrical power or batteries to operate, and with a service life of 20 years unless otherwise indicated.

D. Photoluminescent Exit Signs: Illuminated with photoluminescent-pigmented material for emergency illumination, activated by ambient light, and requiring no electrical power or batteries to operate.

2.05 LED DRIVERS

A. Manufacturers:
   1. Manufacturer Limitations: Where possible, for each type of luminaire provide drivers produced by a single manufacturer.
   2. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Lighting Controls: See Section 26 09 23.

2.06 LAMPS

A. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.

4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.07 ACCESSORIES

A. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 and NECA 502.

E. Provide required support and attachment in accordance with Section .

F. Provide required seismic controls in accordance with Section .

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure pendant-mounted luminaires to building structure.
   4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   5. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Install canopies tight to mounting surface.
4. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

O. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

P. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

Q. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

R. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test emergency lighting units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500, NECA 502, and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to club opening, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. LED drivers.

C. Lamps.

D. Poles and accessories.

E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section .

C. Section 26 05 37 - Boxes for Electrical Systems.

D. Section .

E. Section .

F. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2025).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. State Approval:

1. Where required, fixtures shall be listed and approved by the state of California.

1.05 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Failure to promptly submit shop drawings per this specification for scheduling purposes shall not be an acceptable reason for substitution.

C. Submit in booklet form with separate sheets for each fixture, assembled in alphabetical order and labeled by luminaire type as indicated on drawings.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
   3. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   4. Shop drawings for custom fixtures shall be accurately drawn and dimensioned to indicate all critical design elements of the fixture, including wiring, ballasts (if required), and mounting information.
   5. Provide photometric calculations where luminaires are proposed for substitution upon submittal.
   6. Provide structural calculations for each pole proposed for substitution upon submittal.

E. Samples:
   1. Provide one sample of each specified luminaire where indicated.
   2. Provide one sample of each custom luminaire upon request.
   3. Provide one sample of each luminaire proposed for substitution upon request.
   4. Provide one sample of each product finish illustrating color and texture upon request.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Basis-of-Design Product: The design for each light fixture is based on the product named.

C. Substitutions: By prior approval.
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of ten working days prior to the bid date and must be made available to all bidders.

2.02 EXTERIOR LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. SSL/LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
   4. References to SSL and/or LED sources shall include the entire solid-state lighting system, including circuitry, LEDs, power supplies, drivers, etc.
   5. CRI and color temperature as scheduled in accordance with ANSI C78.377.

6. NEMA.SSL-1 compliant for operational characteristics and electrical safety of SSL power supplies and drivers. ANSI/NEMA C82.77 compliant for maximum allowable harmonic distortion produced by SSL power supplies.

J. Exposed Hardware: Stainless steel.

2.03 LED DRIVERS

A. Manufacturers:
1. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
2. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.04 LAMPS

A. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.05 POLES AND ACCESSORIES

A. All Poles:
1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
   a. Comply with AASHTO LTS.
   b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
      1) Design Wind Speed: 120 miles per hour (193 kph), with gust factor of 1.3.
   c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
   d. Fatigue Design and Vortex Shedding: Nontapered lighting structures shall be designed to resist vortex shedding-induced loads for critical wind velocities less than approximately 65 fps; 45 mph. Except for round tapered poles, for all poles 20 feet in height or higher, provide a factory installed internal vibration dampener designed to resist fatigue caused by vortex shedding induced loads and natural wind gusts in the pole indefinitely without failure. Apply an importance factor of 0.3 for vortex shedding and 0.44 for natural wind gusts.
3. Material: Steel, unless otherwise indicated.
4. Shape: As indicated on drawings.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

7. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Handhole minimum 2-1/2 X 5 inches in size.
   c. Anchor bolts with leveling nuts or leveling shims.
   d. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.06 LUMINAIRE ACCESSORIES

A. Provide accessory plaster frames for luminaires recessed in EIFS ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section .

F. Provide required seismic controls in accordance with Section .

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Pole-Mounted Luminaires:
   1. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.

b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.

2. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
3. Install separate service conductors, size as indicated on drawings, from each luminaire down to handhole for connection to branch circuit conductors.
4. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Install lamps in each luminaire where required.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to club opening, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 00 00
DIVISION 27 TABLE OF CONTENTS

DIVISION 27 – COMMUNICATIONS

27 05 10 - Basic Requirements for Communications Systems
27 05 36 - Cable Trays for Communications Systems
27 08 00 - Commissioning of Communications Systems
27 11 00 - Communications Equipment Room Fittings and Pathways
27 12 00 - Identification for Communications Systems
27 12 50 - Operation, Maintenance, and Warranties for Communications Systems
27 13 00 - Structured Cabling General Requirements
27 13 50 - Structured Cabling for Voice and Data
27 15 00 - Communications Backbone Cabling
27 16 00 - Testing of Communications Systems
27 20 00 - Ambient Sound Distribution and Masking System
27 25 00 - Audio/Visual Systems and Displays
27 41 33 - Broadband Television Distribution System

END OF SECTION

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SECTION 27 05 10
BASIC REQUIREMENTS FOR COMMUNICATION SYSTEMS

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 and other Division 27 sections.

1.02 SUMMARY

A. This contractor shall be responsible for providing the complete installation of systems and components specified in all Division 27 sections. Systems included in this technology package include, but are not limited to, the following:
   1. Communications Systems:
      a. Data and voice communications distribution systems.
      b. Satellite and off air antenna video distribution systems.
      c. Audio/Visual systems.
      d. Local Sound Reinforcement systems.

B. Work Provided by Others (not-in-contract):
   1. Unless otherwise noted, rough-in work for cabling, including boxes, conduits, sleeves, and cable tray are provided under Division 26.
   2. Network routers, hubs, switches, UPS's and rack mount power strips are supplied and configured by owner.
   3. Telephone system.
   4. A/V equipment including video displays and projectors.

C. This contractor shall furnish and install all material specified or described herein and as shown on the plans to provide complete and operating systems. Include supporting devices, accessories, and assemblies, including cable supports, cable runways, and any additional rough-in and pathways as necessary or as noted. The contractor shall provide all necessary configuration of each installed system according to the owner' s requirements, unless noted otherwise.

1.03 BASIC INSTRUCTION

A. Before bidding, the Contractor shall diligently study and compare all contract documents and shall promptly report to the Architect/Engineer any discrepancies or deficiencies discovered by or made known to the Contractor.

B. Discrepancies: Whenever a discrepancy or inconsistency exists between related information indicated on the contract drawings and/or specifications (such as differences between product descriptions and catalog numbers) this contractor shall obtain additional clarification and direction from the Architect/Engineer before proceeding. For bidding purposes, this contractor shall include the labor and materials necessary to comply with the alternative that results in the greatest cost to the Contract.

C. Deficiencies: The Contractor and subcontractors shall resolve all known deficiencies and omissions, including non-compliance with applicable codes, with the Architect/Engineer prior to ordering materials or proceeding with the work. Any work performed prior to receipt of instruction from the Architect/Engineer will be done so at the Contractor’s risk.

D. Manufacturer's Catalog Numbers: Product series, model, or catalog numbers, whether indicated on drawings or specifications, shall not be considered complete. This Contractor shall not order any product based solely upon the stated catalog number. Furnish products including accessories and options necessary to match the full product description and its intended purpose and application based on all information available from the contract documents.

1.04 DEFINITIONS

A. Provide: The term "provide" means "to furnish and install, ready for the intended use and in complete operating condition".

B. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

C. BICSI: Building Industry Consulting Service International.

D. IT: Information technology.

E. LAN: Local area network.

F. LEC: Local Exchange Carrier.

G. NEC: National Electrical Code (NFPA 70).

H. POT: Point of Termination.

I. RCDD: Registered Communications Distribution Designer.

J. UTP: Unshielded twisted pair.

1.05 CODES, PERMITS, AND FEES

A. Comply with all applicable laws, ordinances, rules, regulations, codes or rulings of governmental units having jurisdiction, as well as standards of the National Fire Protection Association and serving utility requirements.
   1. Electrical installations within IT equipment rooms shall comply with NEC Article 645.
   2. IT equipment rooms containing communications equipment (electronic data processing equipment), such as in the main IT equipment room (Head-End) shall comply also with NEC Article 800.

B. Coordinate all permits, fees, inspections, utility connections and extensions and the like associated with work in each section of this Division. Utility installation charges or fees shall be paid directly by the contractor as part of this contract.

C. The Contractor shall procure all easements, permits, and right-of-ways on behalf of the Owner for all outside plant ducts and pathways. The costs of all easements, permits, and right-of-ways shall be included in the Contractor's bid

D. Installation procedure, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.06 CONTRACTOR EXPERIENCE

A. Submit evidence of successful completion of other operational systems of similar size, scope, and complexity upon Owner's request, prior to awarding contract Indicate the following:
   1. Names and locations of two previously installed systems and two most recently installed systems.
   2. Scope description for each system.
   3. Building engineer/technician contact information for each system.
   4. Previous installation experiences.

5. At least two personal references for similar UTP and fiber installations.

B. Installer experience preference: System installer, including all technician journeymen and equipment operators, shall have a minimum of five (5) years of communications cabling experience and prior references of at least 5 projects of similar size, scope, and complexity.

C. Contractor shall be currently licensed to install low-voltage cabling systems in the state where the work is being performed.

D. Contractor shall meet manufacturer's requirements for the provision and installation of specified equipment.

E. The Contractor shall provide a complete list of personnel proposed to perform the work, listing their qualifications and experience with the type and size of work required by the project.

F. The Contractor bidding on communication systems specified herein shall be certified by the product manufacturer to install, service, and warranty the specified product prior to the time of bid and throughout the duration of the installation; or, the bidding contractor shall utilize a sub-contractor(s) certified by the product manufacturer to install, service, and warranty the specified product. Manufacturer certifications shall not be project specific and should be valid for any and all projects completed by the Contractor. The Contractor shall send only qualified personnel to perform work under this section of work.

G. The Contractor shall provide copies of certificates for proof of manufacturer’s training, manufacturer’s certified installer, authorized distributor in the shop drawing submittal and at the request of the engineer to verify compliance with specification prior to recommendations for awarding bid.

H. The Contractor shall provide a complete list of personnel proposed to perform the work, listing their qualifications and experience with the type and size of work required by the project.

1.07 GUARANTEES AND WARRANTIES

A. Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defects of material and workmanship for not less than 12 months from the established Date of Substantial Completion, unless specifically noted elsewhere to be longer than one year, as outlined in the General Conditions. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of equipment under all conditions of load, installing any additional items of control and/or protective devices as required.

B. All cabling shall be tested and certified. All UTP cabling shall meet the minimum requirements listed in section 27 16 00 - Testing of communications systems, part 3.2.B.

C. Refer to individual sections for additional guarantee and/or warranty requirements.

1.08 SUBMITTALS

A. General: Follow the procedures specified in Division 01 Section “Submittals”. Additional submittal copies may be requested or required by the Architect/Engineer for specific sections of these specifications.

B. No part of the work requiring a submittal shall be commenced until the submittal has been approved by the Architect/Engineer. Any related work performed before approval shall be at Contractor's risk.

C. Qualifications:
1. Submit documentation of qualifications as specified in individual Sections.
2. Submit documentation of experience as specified in this Section.

D. Prior Approvals:
   1. Submit for prior approval on Substitution Request Forms. Only written requests on these forms with complete submittal data will be considered.
   2. Refer to each Section for specific submittal requirements.
   3. Final approval of all equipment and materials shall be determined during shop drawing review. Any changes required due to substitution are entirely the Contractor's responsibility (and therefore shall not add any cost to the contract).

E. Shop Drawings:
   1. Prior to submitting shop drawings, the Contractor shall review them and signify by stamping and initialing, compliance with plans and specifications and for dimensional suitability for each application. If any deviation from the specified criteria for any item of material exists, such deviation shall be stated in writing and incorporated with the shop drawings submittal. Review of shop drawings by the Architect shall not constitute agreement of any deviations from the plans and specifications unless such deviations are as specifically listed as required above, and such deviations accepted. Review of shop drawings by the Architect shall not relieve the Contractor from responsibility for errors or omissions in them.
   2. Prepare and submit all required shop drawings at one time. Unless given approval by the Architect/Engineer, piecemeal submittals will be unacceptable.
   3. The complete shop drawings shall be provided in electronic (PDF) format as well as a printed copy, bound neatly in hard cover, 3-ring binders.

F. Record Documents (“As-Built” Drawings)
   1. Prepare and submit record documents in accordance with the requirements in Division 01 Section “Project Closeout”.
   2. Maintain a contract set of record drawings at the site. Neatly mark all changes and deviations from the original drawings. Use a color that contrasts with the prints. This shall be a separate set of drawings, not used for construction purposes, and shall be kept up-to-date as the job progresses. This set shall be made available for inspection by the Architect/Engineer at the job site and submitted for final review prior to project closeout.

G. Cabling Administration Drawings:
   1. Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, 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 convention of TIA/EIA-606. Furnish electronic record of all drawings, in the software and format selected by Owner.
   2. See Division 01 Section, “CAD Electronic Media Transfer Agreement” for obtaining AutoCAD files from the Architect and for associated request form and fees.
   3. Submit final cabling administration drawings to Engineer for review prior to posting on wall in Main IT equipment room (Head-End).

H. Maintenance Manuals:
   1. Prepare maintenance manuals in accordance with Division 01 Section "Project Closeout." In addition to the requirements specified in Division 1, include information as required in all Division 27 sections and the following:
      a. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
      b. Parts list.
      c. Servicing instructions and schedules.

d. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; and summer and winter operating instructions.
e. All applicable warranty certificates and associated documentation.

2. Include copy of Record Documents in Maintenance Manuals.

I. Extra Materials:
1. Submit a signed copy a delivery receipt for spare materials provided, listing each item and its quantity. Differentiate between station cords, patch cords, and various lengths, for example.

1.09 COORDINATION

A. All drawings, specifications and documents for this project shall be taken as a whole. Before undertaking each part of the Work, carefully review and compare all documents pertaining to this project. This contractor shall take into consideration ceiling heights, ceiling types, structural components, mechanical equipment, and other field conditions that may impact the installation and installation costs.

B. Coordinate arrangement, mounting, and support of communications equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
5. In preparation of the contract documents, a reasonable effort has been made to provide layouts based on the selected and specified manufacturers equipment. Since space requirements and equipment arrangement vary according to manufacturer, the final responsibility for initial access and proper fit rests with the Contractor.

C. Coordinate phasing of work with the General Contractor to organize materials and resources to meet the scheduled completion dates indicated.
1. Where the installation of one part of the Work is dependent on the installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results. As necessary, prepare dated memoranda and distribute to each party involved, outlining special procedures required for coordination of their Work.

D. Conduct pre-installation conference at project site.

E. Coordinate backbone cable lengths with pathways including underground pathways.

F. Coordinate work with ceiling grid installation by others. Insure that scope of work includes possible cable installation delays and construction coordination with the work of other trades including installed lay in ceilings.

G. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.

H. Coordinate sleeve selection and application with selection and application of firestopping.
1. Coordinate the installation of firestopping compounds with other trades to facilitate the timely progress of work.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cable until construction in spaces is complete and ambient temperature and humidity conditions are maintained as indicated below, in referenced standards and in manufacturer's written instructions.
   1. Temperature: MDF & IDF should be designed to maintain temperatures between range of 64 degrees and 75 degrees Fahrenheit. One air change per hour is required.

PART 2 PRODUCTS

2.01 SLEEVES FOR PATHWAYS AND CABLES

A. Unless otherwise noted, sleeves and pathways are provided under Division 26 (by electrical contractor).

B. Where additional conduits are needed beyond those shown on the drawings to accommodate the installation of systems cabling, this contractor shall include such provisions in this contract. Provide conduit suitable for its application and sized in accordance with the National Electrical Code (40% fill capacity). Install conduit in accordance with industry standards. Holes in masonry shall be made with rotary drills; impact tools are not permitted. Never penetrate through structural members or architectural finishes without prior approval from the architect or engineer. All penetration work shall be patched, sealed, cleaned, and returned to original conditions. Include nylon bushings at conduit ends and firestopping as required wherever building barriers are penetrated. If necessary, this contractor shall hire a qualified contractor to perform this work.

C. This communications contractor is responsible for creating a waterproof seal in and around openings to the building exterior created by or used by the communications contractor. All waterproof sealing materials shall comply with appropriate codes and shall be installed in accordance with manufacturer’s instructions.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

D. Right of Way: Give to piping systems installed at a required slope.

E. The communications contractor shall clean up all debris related to Division 27 work on a regular basis leaving the job site in a clean, safe condition.

F. Ground (grass and soil conditions) disturbed by the installation of buried communications cabling and duct shall be restored to the original condition or better than original condition. Grass, plants, trees, and shrubs shall be restored when damaged; grass shall be seeded or replaced with sod when necessary. The contractor shall be responsible for watering areas of new seed and sod when natural rain is insufficient for good growth.

G. The low voltage contractor is responsible for closing ceiling tiles that they have opened (be mindful of the directional arrows, check with the superintendent for proper orientation).

3.02 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.03 GROUNDING

A. Grounding Bars: Provided under Division 26.

B. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

C. A licensed electrician shall perform all grounding and bonding.

D. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

E. Comply with ANSI-J-STD-607-A and TIA-942.

F. Provide permanent and effective equipment grounding/bonding for technology systems equipment. Connections shall be tightened in accordance with the torque values specified in UL Standard 486A.

G. Bond each equipment rack together and to the ground reference point (ground bar) using a green #4 AWG copper conductor.
   1. Make connections using listed compression connectors.
   2. Bond other metallic equipment in IT equipment rooms to the grounding bus/bar, using not smaller than No. 6 AWG equipment grounding conductor.
   3. All metallic raceways, cable runways, ladder racks, cable trays, and other metal objects shall be bonded together and connected to a grounding bus/bar in the equipment room.
   4. Bond the shield of shielded cable to the grounding bus/bar in IT equipment rooms and spaces.
   5. Flooring in MDF should be tiled and anti-static protection shall be taken as required by equipment. The copper ribbon should extend 3ft into flooring and grounded to ground bus bar.

H. The grounding system shall be a complete system including all necessary components, including lock washers, hex nuts, compression lugs, insulators, mounting screws, lugs, and other grounding hardware.

I. Refer to individual Sections for additional requirements.

3.04 IDENTIFICATION

A. Obtain actual room numbers from Owner prior to labeling. Room numbers shown on the contract drawings may not be the final room numbers and therefore shall not be used for labeling. Cabling administration drawings shall indicate actual room numbers, but may indicate both actual room numbers and floor plan number.

B. Use logical and systematic designations for facility’s architectural arrangement. Coordinate labeling schemes with owner prior to implementation.

C. Cable Schedule: Provide documents in 3-ring binder and hang from terminal board next to Cabling Administration Drawings in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Furnish an electronic copy of final comprehensive schedules for Project, in software and format acceptable to Owner.

D. Cabling Administration Drawings:

1. Develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation.
2. Prepare building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for each technology/telecommunications closet (TC-#), 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 convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format acceptable to Owner.
3. Post final cabling administration drawings (after review by Engineer) on wall in a prominent location in the Main IT equipment room (Head-End). Provide clear acrylic covering (Plexiglass or equivalent) and attach with screws to a painted plywood terminal board.

E. Final labeling shall include: face of patch panel, cable end behind patch panel, cable end within j-box, and faceplate. All terminations and all cables ends on every system shall be labeled.

F. Labeling shall be in accordance with owner requirements.

G. Refer to individual Sections for additional requirements.

3.05 QUALITY CONTROL

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Refer to individual Sections for requirements.

C. Submit test and inspection reports to Engineer for review.

D. Include Original and two (2) copies of warranty documents covering materials, installation, workmanship, and performance.

3.06 CLEANING AND PROTECTION

A. During the progress of the work, keep the premises clean and free of debris. Provide reasonable protection of the system from the normal activities of other workers on site and occupants of the facility.

B. Thoroughly clean all parts of the equipment prior to submittal for substantial completion.

3.07 SYSTEMS ADJUSTMENTS

A. Coordinate any selectable settings, adjustments, or programming with the Owner’s representative prior to final commissioning of systems. Refer to individual Sections for any additional requirements.

3.08 FINAL ACCEPTANCE

A. All project review reports (“punchlists”) submitted by the engineer shall be completed and signed by the Contractor prior to final project acceptance.

B. The Contractor shall schedule and conduct a final project review meeting with the Owner and Engineer to discuss the following items:
1. As-built CAD and PDF drawings must be provided by the low voltage cabling contractor on CD and submitted to LTF IT Telecommunication Engineer. Acceptable CAD format preferred is AutoCAD (DWG).drawings and documentation
2. Test results

3. Warranty and problem resolution procedures
4. Special maintenance procedures
5. A set of T-layer drawings (including bulletins, CCDs and change orders) must be kept and maintained onsite for reference during the construction process.
6. Address any questions of the Owner and Engineer.

C. The Contractor shall complete all additional training for the Owner as specified in other Division 27 specification sections.

END OF SECTION

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SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal cable tray systems:
   1. Metal ladder cable tray.
   2. Metal solid-bottom cable tray.
   3. Metal wire mesh/basket cable tray.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems.

F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA BI-50016 - Cable Tray Installation Guidelines; 2024.

D. NEMA BI 50015 - Metal Cable Tray Systems; 2024.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts. Coordinate work to avoid installation of obstructions within cable tray required clearances.
   2. Coordinate arrangement of cable tray with dimensions and clearance requirements of actual products to be installed.
   3. Coordinate work with placement of supports and anchors required for mounting.
   4. Notify of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

1. Catalog and data sheets to be labeled with intended location(s) of use for each cable tray system.

C. Project Record Documents: Record actual routing of cable tray and locations of supports.

D. Seismic Bracing: Submit deferred submittal to AHJ as required for bracing requirements.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with NFPA 70.

C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA BI-50016, except do not store cable tray outdoors without cover as permitted in NEMA BI-50016.

B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of required components, fittings, supports, and accessories, as necessary for complete system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under service conditions at installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (i.e., no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA BI 50015.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA BI 50015 including applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

A. Manufacturers:
   1. Basis of Design: Cablofil, a brand of Legrand North America, Inc: www.legrand.us/cablofil/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Source Limitations: Furnish cable tray system and associated components and accessories produced by single manufacturer and obtained from single supplier.

B. Comply with NEMA BI 50015.

C. Material/Finishes:
   1. Zinc Electroplated Steel: Comply with ASTM B633.

2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.

D. Metal Ladder Cable Tray:
1. Location: MDF or where indicated on drawings.
2. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
3. Rung Spacing: 9 inches (229 mm) on center for straight lengths.
4. Inside Width: 12 inches (305 mm).
5. Inside Radius of Fittings: 12 inches (305 mm).

E. Metal Solid-Bottom Cable Tray:
1. Location: Customer facing areas with exposed structure.
2. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
3. Bottom Type: Flat..
4. Load/Fill Depth: As indicated on drawings.
5. Inside Width: As indicated on drawings.
6. Inside Radius of Fittings: 12 inches (305 mm).
7. Covers: Solid flat flanged.

F. Metal Wire Mesh/Basket Cable Tray:
1. Location: Customer facing areas with ceilings, back-of-house areas with exposed structure.
2. Material: Zinc-electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
3. Tray Depth: As indicated on drawings.
4. Mesh Spacing: 2 by 4 inches (51 by 102 mm).
5. Tray Width: As indicated on drawings.
6. Inside Radius of Fittings: 12 inches (305 mm).
a. Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify field measurements.

C. Verify dimensions and span/load ratings of cable tray system components.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray system in accordance with the following. Where requirements differ, comply with most stringent.
1. NECA 1 (general workmanship).
2. NEMA BI-50016 (cable tray).

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at specified elevation.

F. Cable Tray Movement Provisions:
   1. Provide expansion fittings where cable tray is subject to movement, including but not limited to:
      a. Where cable tray crosses structural joints intended for expansion.
      b. Long straight cable tray runs in accordance with NEMA BI-50016.
   2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA BI-50016.
   3. Set gaps for expansion fittings in accordance with NEMA BI-50016.

G. Cable Provisions:
   1. Use fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
   2. Use drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
   3. Use cable support fittings for long vertical cable tray runs with heavy cables.

H. Provide end closures at unconnected ends of cable tray runs.

I. Cable Tray Support:
   1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA BI-50016, BICSI ITSIMM, and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment where not furnished by cable tray manufacturer.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

J. Grounding and Bonding Requirements:
   1. Install cable tray grounding in accordance with the following. Where requirements differ, comply with the most stringent.
      a. NEMA BI-50016 (cable tray).
   2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified cable tray connectors to provide electrical continuity. Do not use classified cable tray connectors where cable tray sections have been modified, such as being bent, cut, or reshaped.

K. Penetrations: Install firestopping to preserve fire resistance rating of building elements.

L. Install cable tray covers where indicated.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect cable tray system for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective cable tray system components.

3.04 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION

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SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

J. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

K. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

L. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Identification for Communications Systems
   2. Ambient Sound Distribution and Masking System
   3. Audio/Visual Systems and Displays
   4. Broadband Television Distribution System
   5. Video Surveillance
   6. Area of Refuge/Rescue Assistance Systems

END OF SECTION

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS AND PATHWAYS

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 SECTION INCLUDES

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cable Runway: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.

C. LAN: Local area network.

D. RCDD: Registered Communications Distribution Designer.

E. LEC: Local Exchange Carrier.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   1. Submit data for each of the following components:
      a. Equipment racks.
      b. Cable runway.
      c. Horizontal and vertical wire management.
      d. J-hooks, D-rings, lacing bars, tie-wraps.

B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
   3. Cable runway layout in equipment rooms, showing routing to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to the sides of cable runway.
      c. Vertical elevation of cable runways above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding the manufacturer's ratings for the cable runway and its support elements.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Lead Cable Installer must have five years of communications cabling experience and prior references of at least five projects of similar size, scope and complexity.
2. Installation Supervision: Installation shall be under the direct supervision of a Senior Technician or Level 2 Installer (or equivalent), who shall always be present when work of this section is performed at project site.

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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

E.

F. Grounding: Comply with ANSI-J-STD-607-A.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.07 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with LEC.
1. Meet jointly with telecommunications and LAN equipment suppliers, LEC representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 PRODUCTS

2.01 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. J-hooks: Steel, UL listed, ultimate static load limit 50 lbs. minimum. Wide base, beveled edges. Rated to support Category 6 cables, and optical fiber cables. Integral Velcro strap. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, drop wire/rod, C and Z purlin clips.
1. Provide products manufactured by one of the following:
   a. Chatsworth Products (CPI) # 31422-801 series.
   b. Caddy by Erico, Inc.
   c. B-line

C. Provide plenum rated velcro straps, length and strength as required to organize and bundle cables. Vinyl tie straps are prohibited throughout. Do not use vinyl to temporarily organize cables.

D. Existing building structure may be used to support cabling, if the structural members are smooth, free of burrs, and have adequate surface area to prevent deforming of cable jacket. Bundle cables with Velcro when utilizing existing structure for support. Coordinate with other trades for locations.

E. Cable Runways in Equipment Rooms:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
      a. Cablofil Inc.
      b. Chatsworth Products, Inc. (CPI)
      c. CommScope
      d. Cooper B-Line, Inc.
      e. GS Metals Corp.
      f. Hoffman (a Pentair Company).
   2. Cable Runway Materials: Tubular steel cable runways made of 3/8-inch” x 1-1/2-inch x 0.065 wall rectangular welded sections, with welded cross members every 12-inches. Includes standard manufactured 90-degree sweeps, horizontal and vertical bends, cable drop-outs, mounting hardware, brackets and assemblies which shall be equivalent to owner preferred solutions, or approved equal in this section.
      a. 12" wide ladder rack. Black in color. CommScope Part #: CR-SLR-1OL12W.
      b. Wall angle support kit. Black in color. CommScope Part #: CR6-12WRSK.
      c. Four T-junction ladder brackets. CommScope Part #: CRTJSK.
      d. Butt-splice ladder clamps. CommScope Part #: CRBSK.
      e. Two ladder rack protective end caps. CommScope Part #: CRPECK.
      f. Cable runway 90 degree radius flat bend. CommScope Part #: CR90FCB-12W.
      g. Cable runway, rung drop out. CommScope Part #: CRDK-12W
      h. Runway to rack mounting kit. CommScope Part #: CRR2RRMK.

F. Conduit and Boxes: Provided under Division 26 (by electrical contractor), unless specifically noted otherwise. Where additional conduit and boxes are needed to comply with these specifications and drawings, this Contractor shall comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

2.02 BACKBOARDS

A. Backboards (Terminal Boards):
   1. ¾” fire rated plywood, painted to match adjacent finishes, with the fire rating stamp on each piece remaining visible (unpainted).

2.03 EQUIPMENT FRAMES/RACKS/CABINETS

A. Manufacturers: Subject to compliance with requirements, provide the following product or approved equal:
   1. Hoffman (a Pentair Company).

B. Open Four-Post Adjustable Frame Requirements:
   1. Freestanding, steel units designed for rack mounted server support and coordinated with dimensions of units to be supported.
   2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
   3. Rack Height: Approximately 96 inches (2130 mm), providing a mounting space of 51 rack units (1 RU = 1¾”). Each mounting space shall be marked and numbered on the mounting channel.

4. Finish: Manufacturer's standard black, baked-polyester powder coat.
5. Cable Management:
   a. Vertical wire management devices: Approximately 6 or 10 inches wide as indicated by 4 inches deep double-sided, mounted either side of vertical rack frames. Provide with removable front and rear covers. Provide two (2) wire retainers for each 12 inches of duct. Basis of design: Hoffman # DV10D8 / DV06D8.
   b. Horizontal wire management devices: Horizontal distribution channel front only. Provide slotted wall wiring duct with hinged metal cover. 2 RMU tall by 8” deep. Basis of Design: Panduit # NCMHAEF2.
6. When assembled with top and bottom pans and angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment.
7. Grounding lug.
8. Anchor to floor with four bolts. Anchor to wall with ladder rack.
9. Rack construction method shall ensure an electrically bonded structure for ease of grounding.
10. Alternating hole-pattern: 5/8” – 5/8” – 1/2”, compatible with EIA 1-1/4” – 1-1/2” alternating hole-patterns.
11. Quantities of Mounting Screws: Quantity needed to mount equipment plus 12 spare screws per rack.
12. Basis of Design: Hoffman E4DR19FM51U-96.00 x 20.25.

C. Swing Gate Wall Rack:
1. Wall mounted, extruded aluminum units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
3. Rack Height: Provide a mounting space of 25 rack units (1 RU = 1¾”). Each mounting space shall be marked and numbered on the mounting channel.
4. Finish: Manufacturer's standard black, baked-polyester powder coat.
5. Alternating hole-pattern: 5/8” – 5/8” – 1/2”, compatible with EIA 1-1/4” – 1-1/2” alternating hole-patterns.
6. Quantities of Mounting Screws: Quantity needed to mount equipment plus 12 spare screws per rack.
7. Grounding lug.
8. Basis of Design: Hoffman RW25-18
9. Dual hinges open to right or left stopping in 90-degree position.

2.04 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS AND SAFETY MEASURES

A. Removing Trench Duct Cover Plates:
1. Remove trench duct covers with suction cups lifter, Legrand part #485 or equivalent. Do not use screwdrivers.
2. When heavy material or equipment loads will be placed on or moved over the duct system, install temporary planking that will transfer loads to adjacent concrete

B. Trench Duct Safety:
1. A barricade must be placed a minimum of 6 feet around the opening of the Trench Duct.
2. A barricade could be made from wood with top rail of 42” AFF and middle rail of 21” AFF. Caution floor 36” safety cones with Danger Keep Out (red) tape could be used as well.
3. “Danger Due To” signs must be posted around barricade.
4. Communicate all safety barricades with superintendent.

2.05 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.06 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 EXECUTION

3.01 EQUIPMENT AND PATHWAYS

A. Entrance pathways shall comply with Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Comply with NECA 1.

C. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

D. Cable Runways in Equipment Rooms: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

F. Cable Supports shall be installed at intervals not exceeding 5' and shall be installed directly to beams, ceiling structure, or walls independent of other trades anchoring/hanging systems; furnish and install all required fasteners and anchoring equipment for cable support system. Install cable supports in accordance with manufacture manufactures fill capacities and per NEC requirements.

G. The communications cabling contractor shall verify bushings have been installed on all conduit ends and conduit sleeves, and provide bushings as required, prior to installing communications cabling to avoid damaging cable sheathing.

3.02 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Refer to Division 27 Section “Basic Requirements for Technology Systems” for additional requirements.

3.03 BACKBOARDS

A. Provide ¾” fire rated plywood installed the full length of wall behind data equipment racks, A/V cabinet, and along the same wall as demarcation; 60 days before grand opening date.

3.04 IDENTIFICATION

A. Identify system components, cabling, and equipment complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

B. Label each equipment rack with its technology closet number at top (TC1, TC2, TC3, etc. depending upon its location).

C. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 27 12 00
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the identification and labeling for all Division 27 communications systems.

B. Identification and labeling for communications shall conform to ANSI/TIA/EIA 606 standards, labeling requirements specified herein and as indicated on detail drawings.

1.02 SUBMITTALS

A. Included with the shop drawing submittals, the Contractor shall provide a sample of all label types and labeling methods planned for use on the project. The labeling sample submittal shall include the following items:
   1. Labels attached to an 8½x11 sheet of paper with a written description of each label and the intended use for each label
   2. Provide one sample of custom style faceplates including engraved labeling
   3. Indicate the labeling method and labeling scheme intended for identifying both end of cables (on cabling sheathing).

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Labels shall be machine generated (unless other methods are specifically indicated) and shall be made with the Brady TLS 2200 thermal labeling system or approved equal labeling system. Labels shall be a permanent polyester material clear in color (or color matching/near color of material affixed to label) with label lettering black in color (or of a contrasting color; i.e., white letters on black label when label is placed on black surface).

B. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels, etc.

C. The Engineer and Owner shall approve the Labeling scheme prior to the installation of any cabling.

D. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, and schematic diagrams.

3.02 LABELING OF CABLES

A. All structured cables (horizontal and backbone) shall be labeled at both ends within 3” of cable termination point. Where voice backbone cables extend behind termination blocks, cable labels shall be places at a location on the cable where the labels are visible from the front of the termination blocks.

B. Labels shall have an adhesive backing and shall wrap completely around the circumference of the cable sheathing. Label and lettering sizes shall be of appropriate size for the varying cable sizes.

C. All of the Cat 6 Jacks within the club are within specific Emergency 911 Zones (e.911). These zones are in place so that calls to 911 originate from a general area of the club that will give the first responders more detailed information about the location within the club that the emergency is taking place (or was reported). It will provide the first responders with information like “Life Time, Indoor Pool, and Main Entrance” for example.

D. The cabling within the club has been installed in a pattern that allows for growth or the installation of additional drops in the future without creating a messy cabling or numbering scheme. Each e.911 zone within the club terminates onto a patch panel(s) dedicated to that zone. For each zone, cables are terminated onto 48 port Patch Panels, even if there are less than 48 jacks in the zone. The numbering from panel to panel allows for jacks to be added to a zone at a later date without throwing non-sequential jack numbers into a zone. Because of this, there are gaps in the jack numbers installed within the club, as the entire jack numbers within a zone have been reserved for that zone.

3.03 LABELING OF EQUIPMENT RACKS AND TERMINATION HARDWARE

A. All communications equipment racks, cabinets, fiber enclosures, and termination hardware shall be clearly labeled at the top, left-hand corner of the equipment.

B. Equipment Racks and Cabinets shall have 3/4” to 1” high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character in sequence for each rack/cabinet; labeling scheme shall match existing.

C. Fiber Enclosures shall have 3/8” to 1/2” high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the enclosure number; labeling scheme shall match existing. Additionally, each strand of fiber shall be identified with the termination location of the opposite end and the fiber position number on the outside (or inside) front cover and top, left-hand corner of the enclosure under the enclosure label.

D. Patch Panels shall have 3/8” to 1/2” high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the patch panel number; labeling scheme shall match existing utilizing resident unit room numbers.

E. Voice Termination Blocks shall have voice backbone cable pairs labeled starting with V001 starting at the main communications room and continuing sequentially and matching existing labeling scheme.

3.04 LABELING OF FACEPLATES

A. Work Area Outlets shall have 3/16” high lettering with the labeling method as indicated in Specifications Section 271543 and on detail drawings. Voice and data outlets shall be identified utilizing resident unit room number matching existing labeling scheme. The contractor shall terminate all cabling in a sequential method.

END OF SECTION

SECTION 27 12 50
OPERATION, MAINTENANCE, AND WARRANTIES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the general operation, maintenance, and warranty requirements relating to all Division 27 systems.

B. This section will also cover any special training requirements the Contractor is required to provide to the Owner.

1.02 GENERAL COMMUNICATIONS SYSTEMS OPERATION AND MAINTENANCE REQUIREMENTS

A. All Communications Systems shall be demonstrated to be operation to the Owner and Engineer by documented test results and/or actual performance demonstrations of installed components. Systems shall perform at or beyond levels described in this section or other Division 27 sections.

B. Structured Cabling shall perform at or beyond levels required to obtain the specified connectivity hardware manufacturer's applications assurance warranties and as required by Section 27 08 00 (Testing of Communications Systems).

1.03 COMMUNICATION SYSTEM WARRANTIES

A. All Communication Systems shall include a one-year workmanship warranty from the Contractor. The workmanship warranty will start at the Substantial Completion Date which is the date mutually agreed upon between by the Owner, Contract, and Architect/Engineer; A.I.A. form G704 (Certificate of Substantial Completion) will document this date. The Contractor's workmanship warranty shall provide corrective action, at no cost to the Owner and in a timely manner, for instances where products are found to be defective, poor installation practices have been discovered, specified work was found to be incomplete, or communications systems are unable to perform properly on the cabling systems.

B. Extended and Special Manufactures Warranties and/or Service Agreements will be required as described below for the following systems or system components.
   1. Category 6 Cabling, Connectivity Hardware, and Patch Cables shall be covered by a warranty offered by the connectivity hardware manufacturer; this warranty shall provide coverage if the cabling system fails to perform under any of the following applications:
      a. 10BaseT, 100BaseT, or 1000BaseT
      b. 155/622 Mbps ATM
      c. Voice-Over-IP (analog or digital)
      d. 100 Mbps TP-TMD
      e. Analog and Digital (Baseband/Broadband) Video
      f. The application assurance warranty shall be structured in a manner that the Contractor providing corrective services will be reimbursed by the warranty provider when the manufacturer's warranty requirements have been met. The Contractor shall register the cabling system with the connectivity hardware manufacturer to obtain the warranty for the Owner and include the approved warranty certificate in the final as-built records. The Owner will be responsible for adhering to the warranty stipulations if they should desire to continue receiving applications assurance warranty coverage.

PART 2 PRODUCTS

2.01 NOT USED (REFER TO OTHER DIVISION 27 SECTIONS)

PART 3 EXECUTION

3.01 GENERAL OPERATION, MAINTENANCE AND WARRANTY DOCUMENTATION REQUIREMENTS

A. System Operation Manuals for all system components shall be provided to the Owner and included with the as-built documentation. 3-ring binders with all documentation hole punched, neatly, organized, and index tabbed shall be provided

B. Manufacture & Extended Warranties for all system components shall be provided to the Owner and included with the as-built documentation. 3-ring binders with all documentation hole-punched, neatly, organized, and index tabbed shall be provided.

3.02 COMMUNICATIONS SYSTEMS TRAINING

A. Structured Cabling System Training shall be reviewed by the Contractor in a final project close-out meeting with the Engineer and Owner's representatives. The training on the structured cabling system shall include, but not limited to, the following items:
   1. Review of the distribution and labeling method schemes
   2. Review of patch panel and rack layouts
   3. Review of as-built drawings and documentation
   4. Explanation of test results and data
   5. Review of Engineer's Final Project Review Report with discussion of resolutions for any outstanding items
   6. Explanation of Quality Assurance Warranties, 1-Year workmanship warranty, and any other extended warranties
   7. Discussion of future problem resolution procedures
   8. The Contractor shall provide a written outline of the meeting including important contact information (i.e., phone numbers and contact personal for problem resolution).

END OF SECTION

SECTION 27 13 00
STRUCTURED CABLING GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers general installation practices for all Division 27 series communications cabling and equipment products.

B. All work specified under Division 27 series sections shall follow installation practices described herein and all guidelines as established by the following codes and standards:
   1. ANSI/EIA/TIA-568-C.0 and C.1 (Commercial Building Telecommunications Cabling Standard – General Requirements)
   2. ANSI/EIA/TIA-568-C.2 (Commercial Building Telecommunications Cabling Standard – Balanced Twisted-Pair)
   3. ANSI/EIA/TIA-568-C.3 (Optical Fiber Cabling Components Standard)
   4. ANSI/NECA/BICSI-568 (Standard for Installing Commercial Building Telecommunications Cabling)
   5. NFPA 70 (National Electrical Code)
   6. OSHA Regulations
   7. All addenda to the codes, standards, and regulations lists above shall be applicable.

1.02 OVERVIEW OF STRUCTURED CABLING WORK

A. The structured cabling work includes all cabling and components required for the voice and data communications systems.

B. Other systems, including CCTV, TV, Audio-Video, Security, Paging, Intercom, or other smart building systems may utilize portions of the structured cabling system. Should other systems need special structured cabling requirements, specific reference will be made in other specification sections and/or on drawings.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. All cable, equipment, and components shall be installed in accordance with manufacturer’s written instructions, in compliance with NEC, and in accordance with industry standard practices.

B. All equipment shall be installed in a neat, professional manner, always vertically plumb and securely fastened.

C. Equipment and cable colors shall be consistent throughout the entire project unless specifically noted otherwise. In example, if horizontal data UTP cable is specified as blue, then blue cable shall be used throughout the entire project; or, if equipment racks are specified as black, then black racks, black rack mounting screws, and black cable mangers shall be used throughout the entire project.

D. All equipment racks/cabinets, cable tray, cable runways, and metallic sheathing on cables shall be bonded and grounded to the communications grounding system; refer to Section 27 05 10 (Basic Requirements for Communications Systems) for more information.

E. All equipment, cabling, and terminations shall be labeled; refer to Section 27 12 00 (Identification of Communications Systems) for more information.

F. The communications cabling contractor shall provide approved fire-stopping materials in and around any opening created for communications cabling where code or good installation practices suggests or requires fire-stopping materials.

G. All sleeves in smoke rated walls and floor penetration openings shall be fire stopped using either a pillow or fire protection putty per prevailing code requirements upon completion of cable installation; mineral wool is to be placed inside the sleeve. For proper fire stopping the fill ratio (cable to sleeve volume) will range from a minimum of 12% to a maximum of 40%.

3.02 CABLING INSTALLATION PRACTICES

A. All cabling shall be installed in accordance with manufacturers' written bend radius and pulling tensions. General industry guidelines recommend the following bend radius and pulling tensions:
   1. Tensile loading on a single 4-pair copper UTP cable shall not exceed 25 lbf.
   2. Bend radius of a single 4-pair copper UTP cable shall not exceed 4 times the diameter of the cable.
   3. Bend radius of multi-pair copper UTP and optical fiber cable shall not exceed 10 times the diameter of the cable.
   4. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

B. All conduits and conduit sleeves shall have bushings or grommets shall be installed prior to the installation of communications cables to avoid damage and abrasions to cable sheathing and insulation. If bushings have are installed by the electrical contractor, the communications cabling contract shall furnish and install bushings prior to pulling communications cabling.

C. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The LVC contractor is responsible for installing station cabling in a fashion as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to Life Time Telecommunications Engineer prior to installation. Life Time Telecommunications Engineer should approve changes to the plan.

D. Splices are not permitted in any voice or data cable unless other specified or show on drawings. All cables shall be installed splice-free from telecommunications rooms (MDF, IDF) to the work out area (WOA).

E. Avoid placing copper cables near sources of extreme heat (i.e., boilers, radiators, heat coils).

F. Maintaining cable twists for all UTP cables. For terminations cable sheathing shall be stripping back no more than ½" back from termination point for all Category 5e and Category 6 cables.

G. All cables shall be supported by cable tray, cable runway, Arlington Strap or J-hooks. When large quantities of cables leave trays or runways, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection). Cables shall not be supported from ceiling grid wires. Cables shall not run above iron joists.

H. All cables shall be separated and bundled into like groups by cable sheathing colors.

I. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 24” service loop shall be installed in the ceil space near workstation outlets at the last support (e.g. Arlington Strap) before the cables enter a fishable wall, conduit, surface raceway, or box; excessive cable shall not be coiled in outlet boxes. A 10’ service loop shall be provided in communication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels; the 10’ service loop shall be neatly bundled and secured in ceiling space with large D-rings or place in cable trays. Manufacturers’ minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

J. Any cabling installing in equipment rooms shall be neatly placed in cabling trays, cabling runways, or horizontal and vertical rack/cabinet cable managers. When tray, runways, or cable managers are not specified, cable shall be neatly installed with Ladder Racking or D-rings. Cables shall always be installed vertically/horizontally or at right angles to structure.

K. Utilize Velcro straps to secure permanently installed horizontal and backbone cabling; any cable ties installed in plenum ceiling spaces shall be rated for use in plenum spaces. Cable ties shall never be secured too tight whereby potentially changing the cable geometry. Do not use vinyl tie straps.

L. All Category 3, Category 5e and Category 6 cables shall be terminated TIA/EIA-568B.

M. Free-air installation shall be installed as follows:
   1. Cable shall be run at right angles and be kept clear of other trades' work.

N. Cable shall never be laid directly on the ceiling gird.

O. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.

P. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

Q. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

END OF SECTION

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SECTION 27 13 50
STRUCTURED CABLING FOR VOICE AND DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Category 6 Cable, Jacks, Faceplates, Surface Mount Boxes (SMB), and Patch Panels.

1.02 RELATED REQUIREMENTS

A. Section 078413 – Firestopping.

B. Section 260537 - Boxes.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. TIA/EIA-568-C.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev C, 2012; Addenda 1-7.

C. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; 2012.

D. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 for Administrative Requirements and submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.

C. Installer Qualifications.

D. Field Test Reports.

E. Project Record Documents:
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on contract drawings.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Installer Qualifications: A company having at least 5 years experience in the installation and testing of the type of system specified, and:
   1. Contractor employs a BICSI Registered Communications Distribution Designer (RCDD) and BICSI Certified Technicians.
   2. Supervisors and installers factory certified by manufacturers of products to be installed.

C. The contractor shall become familiar with installation guides and any other miscellaneous installation documentation prior to the commencement of the work.

D. Any discrepancies between the design specifications, drawings, field conditions, and manufacturer's recommendations shall be brought to the attention of Life Time immediately in writing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The cabling contractor shall be responsible for the procurement, storage and security of all materials either purchased by or supplied to the contractor for installation throughout the project.

B. All cables and components shall be protected from damage through the construction project.

PART 2 PRODUCTS

2.01 SUMMARY

A. Unless noted otherwise, all products shall be owner preferred product solutions listed in sections 2.02 through 2.13 or be approved equal.

2.02 CATEGORY 6 CABLES

A. Cable shall consist of 4-pair plenum rated balanced Unshielded Twisted Pairs U/UTP. 100 OHM, 22 AWG to 24 AWG, insulated solid-copper conductors.

B. The cable shall be high performance capable of supporting bandwidths more than 10/100/1000 MBPS for lengths up to 100 Meters (328 Ft).

C. Cable shall be white.

D. Approved products:
   1. Panduit Part #: PUP6C04WH-U
   2. CommScope Part #: 2071E-UTG ETL

2.03 JACKS

A. Cat6 U/UTP jack, white in color.

B. Approved products:
   1. Panduit Part #: CJ688TGWH
   2. CommScope Part #: MGS400 White

2.04 FACEPLATES

A. The color of the faceplates shall be coordinated with finish conditions listed in Division 26 27 26 Wiring Devices.

B. All faceplates shall be covered and protected against dust and paint during construction.

C. 1-Port Faceplate:
   1. Flush mounted faceplate for Cat 6 jacks.
   2. Approved products:
      a. Panduit Part #: CFPL1WHY
      b. CommScope Part #: M10L-262

D. 4-Port Faceplate:
   1. Flush mounted faceplate with labels.
   2. Approved products:
      a. Panduit Part #: CFPL4WHY
      b. CommScope Part #: M14L-262

2.05 SURFACE MOUNT BOX (SMB)

A. SMB port capacity should match the cable quantity.

B. Color of SMB shall match the color of the 8P-8C RJ45 jack.

2.06 CATEGORY 6 PHONE PLATE

A. Wall phone plate:
   1. Stainless steel.
   2. 8P-8C RJ45 jack insert.

2.07 PATCH PANELS

A. 24-Port Cat 6 Patch Panel:
   1. Patch panel shall be black.
   2. Patch panel shall be flat.
   3. Patch panel shall be preloaded.
   4. Patch panel shall be Panduit, CommScope or approved equal.

B. 48-Port Cat 6 Patch Panel:
   1. Patch panel shall be black.
   2. Patch panel shall be flat.
   3. Patch panel shall be preloaded.
   4. Patch panel shall be Panduit, CommScope or approved equal.

2.08 PATCH CORDS

A. All patch cables shall be furnished by the LVC Vendor and installed by Life Time LVC Engineer.

B. Items patched in to the switches should use an appropriately colored patch cable for easy identification and line tracing. Both the color of the patch cable as well as the switch port should be determined by the type of device being patched in.

C. Quantities of patch cables for data and voice shall be provided by the owner. Quantities of patch cables for the audio and visual systems shall be provided by the audio/visual contractor.

D. All patch cables shall be Cat 6. (28 AWG high-density patch cable to optimize the space in equipment racks cable management) and the modular plug be tangle free with strain relief boot.

E. Items patched in should be routed and protected properly utilizing the provided cable management hardware on the Racks. Items in the IDF Rack should also be bundled utilizing the Velcro Cable Wraps to protect them from being snagged or ripped out.

F. Copper patch cables shall be the following lengths and colors:
   1. Manufacturers:
      a. Panduit Part #: UTP28SP6
      b. CommScope Part #: UNC6 series
   2. Fitness Floor TV's and Fitness Cardio Equipment
      a. Color: Black.
      b. Length: 5 ft.
   3. Club Network Devices at MDF/IDF Equipment Rooms
      a. Color: Blue.
      b. Length: 7 ft.
   4. Servers / WAN Links at Building Demarcation/MDF/IDF Equipment Rooms
      a. Color: Red.
      b. Length: 7 ft.
      c. Length: 14 ft.
   5. Analog Dial Tone at MDF/IDF Equipment Rooms
      a. Color: White.
      b. Length: 7 ft.
      c. Length: 14 ft.

6. Work Area Outlet / Station Cords
    a. Color: Black.
    b. Length: 7 ft.
    c. Length: 14 ft.
7. Video Surveillance Cameras at MDF/IDF Equipment Rooms
    a. Color: Black.
    b. Length: 7 ft.

2.09 WORK AREA OUTLET STATION CORDS

A. Station cords shall be similar to patch cords.

B. All station cords shall be Cat 6 and be black in color.

C. All computer and phone station cords shall be 7' long, furnished and installed by owner.

2.10 WIRELESS ACCESS POINTS (AP)

A. Cabling for wireless access points (WAP) is installed by Low-Voltage Cabling Contractor.

B. WAP devices are furnished by Life Time Technology and installed by the Low-Voltage Cabling Contractor per the direction of Life Time Technology.

2.11 FIBER PATCH CABLES

A. Fiber patch cables shall be provided by LVC cabling contractor.

B. 10Gig 50/125um aqua, LazrSPEED.

C. Fiber optic connectors shall be LC to LC unless otherwise noted.Lengths and quantities of fiber patch cable should be confirmed with Life Time Technology prior to ordering.

2.12 EMERGENCY TELEPHONES

A. Emergency phone locations:
    1. Emergency Phones listed are required by owner and no deviation from these make and models will be accepted.
    2. Contractor shall provide and commission emergency phones. The following shall be provided for each location (as applicable):
        a. Men's & Women's Locker Room Wet Spa, Indoor Pool, and Outdoor Pool Locations: Allen-Tel #GB92V14.
        b. Parking Ramps, Pickleball and/or Tennis Court locations: Viking Model E1600-ABLT2EWP.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

3.02 PATHWAYS

A. To reduce or eliminate EMI, the following minimum separation distances from power lines, fluorescent lights and other RF sources such as motors and generators shall be adhered to:
    1. 39 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
    2. 12 inches from power conduits and cables and panel boards of less than 5 kVA.
    3. 18 inches from fluorescent and high frequency lighting fixtures.
    4. 6 inches from flues, hot water pipes, and steam pipes.
    5. 39 inches from power lines of greater than 5 kVA.

B. Conduit:
   1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
   2. Leave pull cords in place where cables are not initially installed.
   3. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
      a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
      b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
      c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
      d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of telecommunications outlets provided under this section.
      a. Locate outlet boxes so that wall plate does not span different building finishes.

D. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

E. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 078413.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
   1. Cables: Install color coded labels on both ends.
   2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.

3.04 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

C. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active; test each voice jack for dial tone.

END OF SECTION

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SECTION 27 15 00
COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers copper horizontal cabling utilized by all Division 27 systems and possibly other intelligent building systems specified by other Divisions.

B. Quantities and pair count for all copper backbone cabling shall be provided as required to complete cabling system as shown on the drawing schematic diagrams.

C. Unless noted otherwise, all product shall be equivalent of the owner preferred solutions listed in PART 2.

PART 2 PRODUCTS

2.01 COPPER BACKBONE CABLING

A. Voice Backbone Cable shall comply with the following requirements:
   1. TIA/EIA Category 3 compliant
   2. 24 AWG solid bare copper conductor, unshielded twisted pair
   3. Industry standard conductor insulation color coding (blue, orange, green, brown, slate); bandmarked PVC insulation
   4. Plenum rated, UL Listed CMP marking on cable
   5. Product identifications and cable distance markings at regular intervals on cable

B. Communications Copper Cable Splicing and Terminations:
   1. Copper backbone shall extend from MDF to IDF(s) and detached Bistro, where applicable.
      a. Category 3 U/UTP plenum rated cable. White cable jacket, 25-pair count.
      b. Approved products:
         1) CommScope Part #: 2010B WH 25/24 R1000
         2) Or approved equal.
   2. Emergency Phone's, POTS Lines Extension, Internal Analog Devices
      a. LVC installer to extend dedicated POTS line to each emergency phone and program emergency phone to ring-down to specific number. Each phone comes with program instructions.
      b. Install Life Time Fitness assigned POTS to fire panel and elevator.
      c. Extend internal analog phone lines to courtesy phones in locker rooms, on the work out floor, analog lines to credit card machines in Life Cafe and Life Spa, and fax machines.

2.02 OPTICAL FIBER BACKBONE CABLING

A. Indoor 50/125µm Multi-Mode Optical Fiber Cable shall comply with the following requirements:
   1. Maximum attenuation of 3.5dB/km @ 850nm and 1.5dB/km @ 1300nm
   2. Plenum rated, UL Listed type marking on cable
   3. Product identifications and cable distance markings at regular intervals on cable
   4. Aramid yarn central strength members
   5. Plenum rated armored cable, aqua in color.
   6. 12-Strand LazrSPEED, 50um OM3, 300m.
   7. CommScope Part #: P-012-DZ-5L-FSUAQ or Panduit equal.

B. Exterior backbone fiber optic cable shall be indoor/outdoor single unit plenum distribution type installed within conduit system. At building entrances, provide termination of all conductive portions of the assembly to ground. Install fiber within plenum rated innerduct or plenum rated armored sheath to fiber interconnection unit for physical protection.

2.03 OPTICAL FIBER CABLE TERMINATING CONNECTORS

A. Provide rack mounted fiber enclosures capable of terminations and splices noted on drawings. Equip with LC connectors and cover plate. Units shall provide top or bottom cable entry, fiber termination, cross connection, interconnection, routing, fiber identification labels, fiber storage and radius organizers.

B. Optical Fiber Connectors shall be LC-type and shall comply with the following requirements:
   1. Comply with ANSI/TIA/EIA 568-B.3
   2. Ceramic ferrules utilizing adhesive for connection to ferrule
   3. Designed for multimode 50/125, 62.5/125µm and single mode fiber
   4. Typical insertion loss of 0.2dB
   5. Coordinate with owner electronics and provide duplex LC connectors where possible.

PART 3 EXECUTION

3.01 GENERAL

A. All backbone cabling shall be labeled on cable sheathing and at termimal points.

B. Wiring in Wire Closets and Cabinets: Install conductors parallel to and at right angles to walls. Bundle, lace, and train the conductors to terminal points and terminate using manufacturer's installation procedures. Connect conductors that are terminated, spliced, or interrupted to terminal blocks.

C. Fire Stopping: Provide fire stopping for all conduit sleeves shown on the plans and as added as required at all fire rated walls. Firewalls are indicated on the architectural drawings and are available for review at the Construction Manager' s office

D. Install cable without damaging conductors or jacket. Do not bend cable to a smaller radius than minimum recommended by manufacturer. Do not exceed manufacturers recommended pulling tensions.

3.02 COPPER BACKBONE CABLING INSTALLATION PRACTICES

A. All pairs of copper backbone cables shall be terminated at both ends.

3.03 OPTICAL FIBER BACKBONE CABLING INSTALLATION PRACTICES

A. The same manufacturer’s product shall be utilized throughout the entire project for all optical fiber backbone cabling.

B. All strands of optical fiber backbone cables shall be terminated at both ends in enclosures.

C. Optical fiber backbone cables shall be installed in cable runways and cable tray systems in such a manner to avoid crushing or cable deformation by other cables. Where optical fiber backbone cables runway/tray support systems, optical fiber backbone cables shall be installed in inter-duct and supported at regular intervals.

D. Splicing of optical fiber backbone cables is only permitted in communication room enclosures for manufacture approved pigtail connectors, at splice enclosures identified on the drawings, or for other special situations with prior approval from the Engineer.

E. A maximum connector insertion loss of 0.75dB is permitted by industry standards; however, typical insertion losses of 0.2dB shall be observed in test results. Contractor may be required to re-terminate connectors if losses are higher than 0.3dB and the to fiber segment loss budgets are excessive.

END OF SECTION

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SECTION 27 16 00
TESTING OF COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers contractor testing, and test result documentation for all Division 27 communications systems.

B. All communications systems shall be tested and documented by the contractor installing each system as specified herein.

C. The Engineer and/or Owner may test up to 5% of the cable runs for any communication cabling system prior to substation completion of the project.

1.02 OVERVIEW OF COMMUNICATION SYSTEMS TESTING REQUIREMENTS

A. Structured Cabling System testing shall be completed for all segments of the structured cabling systems including Category 6 horizontal cabling, copper backbone cabling, and optical fiber backbone cabling. All cables shall be tested and documented as specified herein.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall notify the Engineer a minimum of one week prior to any testing and shall provide a testing schedule prior to the testing of cabling and equipment. Owner's representatives and the Engineer may be in attendance to witness the test procedures. The Contractor shall re-schedule testing as necessary to accommodate the schedules of the Owner/Engineer for any testing the Owner/Engineer may want to witness.

B. All cable runs shall be tested. Any segment with failing or receiving marginal test results shall be evaluated and receive corrective action. Cable runs continuing to fail test results should be evaluated with the Engineer and shall be replaced when necessary to obtain passing test results.

C. All cable runs must receive passing test results prior to final acceptance of the project.

D. All test results shall be documented and included with contractor's final as-built documentation and will be review by the Engineer prior to final acceptance and closeout of the project.

E. The test equipment manufacturer shall calibrate all test equipment at regular intervals as recommended by the manufacturer. Calibration reports shall be provided to the Engineer upon request.

F. Technicians who have completed an appropriate training course for the use of specified test equipment shall conduct all testing.

3.02 CATEGORY 6 HORIZONTAL CABLE TESTING

A. All Category 5e & 6 horizontal cable runs shall be tested with a Level III tester capable of testing 4-pair UTP cable frequencies from 0.1-250 MHz. The Contractor shall use one of the following testers: Agilent Wirescope 350, Fluke DSP-4000, Ideal LanTek 7, or more current/advanced model from these manufactures.

B. Category 6 cabling shall include the following tests:
   1. Wire Map

2. Length
   a. Record all cable lengths.
   b. Any cable runs longer than 295 feet shall be brought to the attention of Life Time Technology in writing.
3. Attenuation (insertion loss)
4. NEXT (near end cross talk—to be performed on all Category 6 cables BI-directionally)
5. Power Sum NEXT
6. Pair to pair ELFEXT (equal level far end cross-talk)
7. Power Sum ELFEXT
8. Return Loss
9. Propagation Delay
10. Delay Skew
11. Permanent Link testing shall be performed and shall conform to the following test result parameters defined by ANSI/EIA/TIA 568-C.2-1for Category 5e or 6 as applicable.
12. In addition to 100% of the cables passing all Permanent Link test parameters, the contractor is required to provide a manufacturer's warranty covering the Channel Link (including patch cords/station cords). Refer to Section 27 01 00 for more information on manufacturer's warranty requirements.
13. Test results (in summary format) shall be printed and bound in a 3-ring binder. Provide two copies of the printed test results with the as-built documentation submittal. In addition to the printed test results, the Contract shall provide the detailed electronic test results (on compact disk) and a copy of the test manufacturer's software to view the test results with the as-built documentation submittal. The test equipment manufacturer's software can be provided on CD or can be instructions on how to download the software (free of charge).

3.03 COPPER BACKBONE CABLE TESTING

A. Multi-pair UTP backbone cables shall be tested for the following parameters:
   1. Wire-map (corrector conductor position on 110 blocks)
   2. Continuity
   3. Shorts
   4. Length
   5. All pairs shall be free of shorts, shall be terminated in the correct position, and shall have continuity. Any discrepancies shall be corrected.
   6. Lengths of all copper backbone cables shall be recorded on as-build documentation.

3.04 OPTICAL FIBER CABLING TESTING

A. All strands of all optical fiber cables shall be field-tested (unless specifically noted on drawings as un-terminated strands for future use). Field test equipment and testing methods for multimode optical fiber cable shall meet the requirements of ANSI/EIA/TIA-526-14A; single-mode field test equipment and methods shall meet the requirements of ANSI/EIA/TIA-526-1. Optical fiber cabling testing shall adhere to the following criteria:
   1. Building backbone fiber cabling shall be tested with a power loss meter for insertion loss (Link Attenuation) in both directions and at both operating wavelengths.
   2. Test equipment shall measure the length and automatically calculate the link loss based on ANSI/EIA/TIA-568-C.1 standard loss values; all links shall receive a PASS value.
   3. Test results, including distances and insertion loss readings shall be printed and bound in a 3-ring binder. Provide two copies of the printed test results with the as-built documentation submittal.

END OF SECTION

SECTION 27 20 00
AMBIENT SOUND DISTRIBUTION AND MASKING SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General provisions of Contract including General and Supplementary Conditions and Division 1, specification sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK

A. Provide equipment and hardware to provide a complete integrated audio distribution system and sound masking system. Furnish all specified materials, products, installation labor, programming, and testing work required for a complete and fully functioning system. Equipment notated on BOM as “OFE” is owner furnished equipment by Life Time. Work includes:
   1. This section pertains to speakers, unless specified otherwise.
   2. The work provided under this specification and the associated drawings, applies to the Facility including indoor and outdoor areas as designated in the drawings.
   3. The audio system will be composed of equipment provided under this Contract. All equipment shall be installed by the A/V Contractor.

B. A conduit / raceway system required to support this equipment will be provided by others.

1.03 DEFINITIONS

A. AV or A/V = Audio Video
B. AVC = Audio Video Contractor
C. BOM = Bill of Material
D. CAD = Computer aided design
E. DMX = Digital Multiplex
F. DSP = Digital Signal Processor (for Audio)
G. EC = Electrical Contractor
H. GC = General Contractor
I. GF = Group Fitness Studio
J. IDF = Intermediate Distribution Frame (Secondary IT Closet)
K. IT = Information Technology (For this document its referred to as a department)
L. LAN = Local Area Network
M. LTF Standards = Life Time Standards
N. LVC = Low Voltage Contractor
O. MDF = Main Distribution Frame (Main IT closet)
P. Misc. = Miscellaneous
Q. NEC = National Electric Code
R. OFE = Owner Furnished Equipment (By Life Time)
S. POE = Power Over Ethernet
T. QLAN = Q-Sys local area network
U. Q-SYS = Manufacturer “Q-Sys”

V. SPL = Sound Pressure Level

W. SOW = Scope of Work

X. UL = Underwriters Laboratories (Safety Standards

Y. XLR = External Line Return (Style of Audio connector)

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Installer Qualifications, Certifications, and General Knowledge:
   1. CTS and Dante Certification by representative working directly on this project.
   2. Dante Certification.
   3. Q-Sys Designer Level 2 Completion.
   4. Experience with Bluebeam Revu, AutoCAD, Microsoft Windows 10, and Microsoft Office Suite.
   5. Network switch configuration experience including, but not limited to, IP addressing, QoS, VLAN, and DHCP.

C. Manufacturers
   1. The system shall be the product of the specified manufacturers, installed by an agency experienced in such work. The installation and connections of all equipment and tests of the operation of the system be made by a representative of the manufacturer or aforementioned installing agency.
   2. Contractor / integrator providing this system must be manufacturer approved to furnish, install, maintain, and warranty the system equipment specified.

D. Installation
   1. Installation of required raceways, conduits, and power receptacles shall be by the electrical contractor. The installation of communication outlets, wallplates, devices, and connections of all parts of the audio system shall be done by the A/V Contractor.

E. Programming
   1. The Contractor shall employ the services of an experienced system programming specialist for the Digital Signal Processor/Control system provided under this specification and an experienced programmer for configuring and programming the audio DSP processing equipment.

F. NEC Compliance
   1. Comply with NEC as applicable to construction and installation of system components and wiring.

G. UL Compliance
   1. Where required, provide system equipment which is UL listed and labeled.

H. Licensing
   1. Contractor shall comply with local licensing, including state and city laws/regulations.

1.05 SUBMITTALS

A. Licensing details.

B. Product Data
   1. Submit manufacturers' data on all equipment, including:
      a. Detailed equipment list indicating the manufacturer, model number, and quantity for each equipment item being provided or existing item being re-installed.

b. Manufacturer's product data sheets for each new equipment item
c. Dimensions, rough-in drawings, installation instructions, and operation and maintenance, suitable for inclusion in maintenance manual.

C. Shop Drawings
1. Shop drawings provided by Life Time. Adjustments required must be sent to Life Time AV representative for review and approval. Submit shop drawing data, including:
a. Detailed wiring diagrams of the system. Diagrams shall show connection to each unit of system. Single-line block diagrams are not sufficient.
b. Detail drawings of all custom fabricated panels, connection wallplates and associated components being supplied.
c. Equipment rack elevation / layout diagrams (front face)
d. Audio DSP programming: Provide for review, a proposed configuration layout indicating all DSP processing functions and internal connectivity for the DSP processor.

D. Speaker 70V System Tap Values
1. Prior to installation provide a speaker tap value list for approval by Life Time AV representative.

E. Inputs and Outputs on DSP/Amplifiers must be submitted to Life Time in Excel format.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prior to acceptance, OFE shall be inspected for damage. If damage on boxes, pallets, or equipment is visible, the shipments shall be rejected and sent back to logistics company. Communicate damage to Life Time AV representative.

B. Store products in manufacturer's packaging. Keep dry and protect from damage until ready for installation.

C. Equipment must be kept locked up at all times in either an on-site storage container provided by AV Installation contractor or within the building in a designated secure location.

D. Contractor shall not install any product in construction areas where the product is subject to damage from water, dust, and construction debris.

E. Contractor is responsible for their own tools and AV components that they are installing. Keep them secure at all times.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide materials in quantities listed in Life Time BOM for a complete and operational system as indicated herein and in the drawings.

B. Coordinate with system block diagrams for verification of specific quantity of equipment items required in each system.

2.02 OWNER PROVIDED EQUIPMENT/MATERIAL (OFE)

A. Reference BOM for purchasing equipment. Do not provide items indicated as OFE.

2.03 CONFLICTS WITH BOM

A. Present conflicts, errors, or omissions to Life Time AV representative for review and approval prior to purchasing.

2.04 SUBSTITUTIONS ON BOM

A. All substitutions outside of owner provided BOM must be presented and approved by Life Time AV representative.

2.05 MISCELLANEOUS MATERIALS

A. Provide list of construction required equipment for installations not called out specifically on BOM.

PART 3 EXECUTION

3.01 GENERAL

A. Wiring, except in equipment cabinets and where raceway or cable tray is provided, shall be routed open above suspended ceilings and in accessible walls and shall be in accordance with manufacturer's directions. All wiring in ceiling spaces shall be plenum rated. In accessible ceiling spaces, wiring shall be supported from ceiling structure at regular intervals of at least 48 inches. Cabling shall not be attached to or supported by ceiling tile support wires.

B. Final wiring connections shall be made and the entire system shall be tested and certified as working properly by an authorized representative of the Contractor. Written verification of test results shall be furnished to the Owner, Architect, and Engineer.

C. Identify and tag all cables with permanent type markers to denote location served.

D. All rack and in-cabinet wiring and cabling shall be neatly routed in plastic wiring duct or secured with tie wraps and routed along rack sides. All splices and connections shall be by plug, solder, or captive screw terminal strips, etc. Splices shall not hang in rack or cabinets.

3.02 INSTALLATION

A. Systems installation, cabling and rack building procedures shall fall in strict accordance with industry standards and manufacturer recommendations for safety and operation compliance.

B. Componentry installed during construction shall be either installed after finish carpentry and drywall sanding/construction is complete or covered in a method conducive to provide a dust free environment for the installed items if the possibility of damage could occur to the item prior to first use by the client.

C. Final installation measures by the AVC shall include cleaning components to eliminate fingerprints, dust, or debris during the installation phase. Additional cleaning required by Life Time prior to first use by client will incur a cleaning fee payable by the AVC.

D. Install all equipment, components, accessories, terminal blocks, connectors and hardware necessary to provide a complete and operational system. Connector types and quantities shown in the drawings are representative and the Contractor shall be responsible to supply any additionally required connectors and wiring. Connectors shall be provided and installed as recommended by the manufacturer of the terminating equipment. All other wiring connections to connectors mounted on input plates and floor boxes shall be soldered connections or crimp (video) connections.

E. All interconnects must be tied neatly with Velcro ties every 12”.

F. Zip ties are not allowed.

G. Cable minimum bend radius after installation shall be no less than 10 times the cable diameter.

H. Speaker installation by type:
   1. In-ceiling /flush mount style speakers
      a. In-ceiling speakers shall be mounted in ceiling tiles or gypsum wallboard ceilings according to the manufacturer’s direct specifications.

b. Unless otherwise stated in writing by the owner, the specifications and mounting techniques will be followed verbatim and applied to site installation.
c. A hole shall be cut using the supplied cut-out template. The speakers will have their terminations made by the installer at the time of concealment in the tile or gypsum.
d. Speaker terminations shall be precisely cut and managed in the connector or crimp methods.
e. A service loop 10” in circumference shall be utilized and relieve strain to speaker connections. Exposure of bare copper conductors is a hazard to the electronics systems and shall not be permitted. In outdoor applications, exposure to the elements leads to corrosion and damage to the integrity of the cable and shall not be permitted.
f. Drop ceiling tiles shall have tile bridge supports in place for all in-ceiling speakers. Tile bridges will be installed per the manufacturer’s specification.
g. The ceiling tile shall not solely support the weight of the speaker.
h. Ceiling grid support pencil rod shall be utilized to support the added weight of the speaker against the ceiling grid. Support pencil rod shall be shot directly into the deck/ceiling or fastened to structural members with beam clamps or a combination of them and d-rings.
i. At no point shall the speaker support pencil rod be secured to existing pencil rod that is used for existing ceiling grid support.
j. The roto-lock clamps will be securely tightened. Moderate resistance felt while securing the clamps will ensure that the speaker has been clamped successfully. Over tightening can damage the clamp and the speaker and make grill installation difficult or unsuccessful.
k. Speaker, clamp, or grill damage shall be the responsibility of the installer and shall be reported to a Life Time AV representative and replaced immediately by the AVC.

2. Surface mount style speakers
a. Surface mount speakers shall be mounted to brick, wood, concrete, or gypsum wall types according to the manufacturer’s direct specifications.
b. Unless otherwise stated in writing by the owner, the specifications and mounting techniques will be followed verbatim and applied to site installation.
c. Where a cabling backbox has been supplied, the speaker shall be mounted directly below the backbox as to conceal the opening with the body of the speaker. The box shall not be covered by the mount in entirety as to retain the ability to access the opening without the need to remove the speaker in times of serviceability or cable replacement.
d. The yoke mount or similar shall be fastened to the surface utilizing the appropriate weight distributing fastener for the application.
e. A proportional weight rating relationship of 5:1 shall be applied when choosing the appropriate fastener and the wall surface in which the device is to be mounted.
f. Plywood backing shall be called out by AVC and installed by GC as required prior to AVC site installation.
g. The yoke mount shall be secured to a wall stud where available.
h. Speaker terminations shall be precisely cut and managed in the connector or crimp methods.
i. A service loop 10” in circumference shall be utilized and relieve strain to speaker connections.
j. Exposure of bare copper conductors is a hazard to the electronics systems and shall not be permitted. In outdoor applications, exposure to the elements leads to corrosion and damage to the integrity of the cable and shall not be permitted.

k. Interior/exterior speaker cabling for surface-mounted speakers shall require a drip/service loop in before securing the cable to the connector or binding post(s) of the speaker/device.
l. Aircraft safety cable shall be applied to all devices based on geographic location and seismic requirements.
m. Consult the local building codes per the authority having jurisdiction for exact safety mounting requirements.

3. Pendant speakers
   a. Pendant speakers shall be mounted (anchored) directly to the corrugated deck/ceiling via dual aircraft cable suspension and a stress relief cable loop.
   b. Unless otherwise stated in writing by the owner, the specifications and mounting techniques will be followed verbatim and applied to site installation.
   c. Fasteners/anchors shall be of the approved type in the fastener/anchor's specifications section below.
   d. Only approved devices will be permitted. If the situation calls for alternate mounting methods. A Life Time AV representative and AV Engineer will be notified prior to installation.
   e. Installation by contractor will only occur if the alternate fastening/anchoring device or method is approved by a life-time project manager.
   f. Interior/exterior speaker cabling for surface-mounted speakers shall require a drip/service loop in before securing the cable to the connector or binding post(s) of the speaker/device.
   g. A service loop 10" in circumference shall be utilized and relieve strain to speaker connections.
   h. Plenum rated zip ties shall be used to bundle the cable above the speaker. Exposed, jacketed speaker cabling between the pendant speaker and ceiling-mounted junction box shall be strapped to the aircraft safety cable, with white plenum rated wire retention straps/ties closest to the ceiling-mounted junction box.
4. Outdoor landscape speakers and subwoofers
   a. Outdoor landscape speakers must be installed flush to final landscape mulch, rock, or other landscape material. Installation shall be level and symmetrical.
   b. Speakers must be installed with supplied burial security feet
   c. Provide direct burial speaker cabling and install from speaker to nearest junction box. All wiring must be hidden from view to the nearby junction box. Drill small hole on side or underside of junction box, supply and install with silicone to fill hole.
   d. All screws/boxes/anchors must be secured to speaker/junction boxes.
5. Subwoofers
   a. Subwoofers shall be mounted according to the manufacturer's direct specifications. Unless otherwise stated in writing, the specifications and mounting techniques will be followed verbatim and applied to site installation.
   b. Ceiling mounted subwoofers
      1) Subwoofer installation locations shall vary by the individual site build.
      2) Anchoring subwoofers must be sufficient enough to hold 4 times the weight of the subwoofer/combo.
      3) Anchoring must be done with two (2) primary anchor cables/chains and one (1) backup safety support anchor.
      4) Anchoring into concrete ceiling use Hilti Kwik Bolt concrete anchors. Length will vary depending on thickness of concrete.

5) Bar joist mounting shall consist of heavy duty uni-strut structure designed to withhold four (4) times the weight of the subwoofer and mount.

c. Floor mounted subwoofers shall be placed on the floor in the approved location. All wire and cabling paths to and from the subwoofer device shall be concealed and dressed in braided cable wrap sized appropriately for the quantity of cables it will conceal.

6. Speaker taps
   a. All speakers shall be tapped to wattage that does not exceed 80% of total wattage per amp channel.

I. Shunted circuits with fire alarm system (code compliance)
   1. All speakers within the facility must mute with activation of the fire alarm system. Life Time uses shunted power outlets and circuits to shut down power to specific audio systems. Installation should follow this guidance and be tested for functionality.

J. MDF and IDF equipment racks
   1. All MDF and IDF equipment racks shall be bolted to the concrete floor by the AVC by appropriate means and hardware relative to the application. Please consult local building safety codes and GC requirements.
   2. Seismic locations may require addition iso-base equipment application prior to permanently affixing equipment or server rack cabinets.
   3. Follow OFE rack layout for equipment layout in rack.
   4. All MDF and IDF equipment rack enclosures shall be properly grounded and bonded to the electrical earth grounding system as specified in the NEC. Please consult with the project EC to determine wire size and additional requirements.
   5. The audio rack layout shall provide for power conditioning and amplifiers stack neatly at the lower end and follow with DSP, AV network devices, baluns etc. to the top with a blank rack panel between each separate component type. Appropriate thermal management shall be employed as required.
   6. All cables shall have labels which depict source and destination which are clearly labeled and visible as stated above in item - 11. Cable Labeling Standards.
   7. Network cabling from patch panel follow network cable color scheme:
      a. Purple depicts all QLAN.
      b. Green depicts AV items.
   8. AV network switches – Netgear.
   9. Do not exceed POE allowances.
   10. Cable management shall be neat, organized, and stress free. Strict adherence to the Avixa Rack Building for Audio Visual Systems Standard is required. Items bulleted below must be calculated and applied in the rack building process.
      a. Velcro cable strap support every 12” (the use of nylon wire ties is prohibited).
      b. Strain relief
      c. Service loops
      d. Horizontal cable management
      e. Vertical cable management
   11. Equipment rack thermal management shall be employed to ensure a nominal temperature of no more than 75 degrees Fahrenheit.
   12. MDF to IDF interconnection runs shall be over fiber as Q-Lan.
   13. Group fitness racks provided by others.
      a. Barre, Pilates, Yoga, Others etc. Small format racks built, populated, and installed/commissioned by AVC.

K. Terminations
1. Soldering
    a. Soldered connections shall follow the ISO 12224 soldiering specification.
    b. All connections require tinned wire tips and solder cups prior to application.
    c. Cold solder joints shall not be permitted.
    d. All connections shall be tested for continuity prior to application of heat shrink material.
    e. Heat shrink material sized appropriately for the specific wire gauge and over-all jacket is required on all connections in an effort to prevent shorts or possible electrical inter-connection between poles or adjacent conductors.
    f. In the event that accidental wire insulation burn-off has occurred which results in bare conductor exposure, the termination shall be void. The connection(s)/termination shall be re-terminated to correct the improper cable/termination state.
    g. If the accidental cable damage does not permit an optimal cable re-termination due to improper length, the cable must be re-pulled/replaced to assure correct fitment of the application.
2. Phoenix style
    a. Follow guidelines below:
        1) Remove the outer jacket of the cable with a cable stripper.
        2) Slide outer shrink wrap over the cable jacket.
        3) Outer shrink wrap should be measured to allow ¼” coverage over outer jacket and ¼” distance from connector housing where applicable.
        4) Spin the shield thoroughly, remove the bare wires. Pre-tinning the shield wires with solder.
        5) Place the cable shrink wrap on the shielded wire 1cm (about 0.39 in) from the end of the conductor ensuring that all bare wire is enclosed in the connector housing upon insertion.
        6) Insert the remaining conductors in appropriate configuration in the connector housing and secure the wires with the 2.5mm (about 0.1 in) flat-head screwdriver.
        7) Affix heat shrink wrap the outer jacket and conductors to form a secure bond without melting the jacket or insulation.
3. XLR
    a. Connections shall be soldered following soldering standards above.
        1) Pinout as follows:
            (a) Pin 1 = Ground
            (b) Pin 2 = Hot/Positive
            (c) Pin 3 = Cold/Negative
        2) Re-solder may be required with excess noise on speakers/sound system.
4. DMX
    a. Connections shall be soldered following soldering standards above.
        1) Pinout as follows:
            (a) Pin 1 = Ground
            (b) Pin 2 = Cold/Negative
            (c) Pin 3 = Hot/Positive
        2) Re-solder may be required.
5. Terminal blocks and barrier strips
    a. Solder tin ends of bare wire. Provide heat shrink as part of AV standards.

b. All barrier strip connections require spade lug termination on speaker cable pair ends prior to termination to barrier strip. Spade lugs are to be specifically sized for the individual cable conductor pairs and neatly terminated/crimped with no exposed copper conductor.

6. Miscellaneous
   a. Amplifier terminations shall require spade lugs specifically sized for the individual cable conductor pairs and neatly terminated/crimped with no exposed copper conductor.
   b. Undefined terminations must use AV standards.
7. Wall plates
   a. Wall plate terminations and face plate, regardless of connection type, shall be free of defects prior to adhesion to wall box.
   b. XLR/DMX connections shall be properly soldered and tested as noted above prior to on-plate connection. All XLR type soldered connections shall have heat shrink tubing applied to prevent shorts.
8. Wall and ceiling boxes
   a. Wall and ceiling boxes shall be properly grounded and bonded to the electrical earth grounding system as specified in the NEC.
   b. Box fill shall strictly adhere to article 314 of the NEC.
   c. Cable slack must be neatly dressed and free from abrasion, stress, or bare conductor conditions.
   d. Cable slack shall provide a minimum of six inches where applicable of working distance from the interior of the box for service or maintenance of internal or plate connections.
   e. Boxes shall be checked and free of scrap material, insulation, bare conductors or loose metallic objects prior to plate adhesion.
      1) Ceiling mounted boxes must be secured via manufacturer's recommendation. Ceiling grid support pencil rod(s) shall be utilized to support the added weight of the speaker against the ceiling grid. Support pencil rod shall be shot directly into the deck/ceiling or fastened to structural members with beam clamps or a combination of them and d-rings.

3.03 IDENTIFICATION AND LABELING

A. Each cable related to AV equipment must be labeled on each end. This includes, but is not limited to:
   1. Speaker cables
   2. Power cables
   3. Network cables
   4. Audio cables

B. Cable labeling shall follow the Avixa/Infocomm F501-01:2015 Cable Labeling for Audiovisual Systems printed standard.

C. Adaptation of other standards shall not be permitted unless specifically stated in writing by an authorized Life Time representative.

D. Each unique identifier (primary data element) should have a prefix and/or suffix determined by the accompanying project documentation.

E. Examples:
   1. Signal type • Cable type designation
   2. Room/floor/building number

3. Location designation of cables
4. Review and adhere to the standard as compliance is mandatory throughout.

3.04 TOOLS AND MATERIALS REQUIRED

A. Provide the following, including, but not limited to:
1. Safety equipment including hard hats, safety vests, steel toe boots, and eye protection.
2. Ladders
3. Scissor lift
4. Lockboxes and storage boxes
5. Hand tools
6. Termination tools
7. Hardware and screws
8. Anchors and ceiling support wires
9. Misc. materials/tools as needed to complete scope of work.

3.05 PROGRAMMING AND COMMISSIONING

A. General
1. The Contractor shall perform all required programming and adjustment of equipment to provide the functions described herein and in the drawings. Final programming of systems must be pre-approved by Life Time AV team.

B. Audio Processor Programming
1. Owner to provide base templates for Audio Signal Processor programming: Configure programming file for internal DSP signal routing and processing of audio DSP system to support all required and specified functions of the audio system, configure for remote control of required functions and to optimize the frequency response of each loudspeaker type used in the system for its specific application. DSP configuration shall provide for the following, via programmable internal routers, matrix mixers, mutes, volume controls, filters, equalizers, signal generators and dynamics processors. DSP shall be programmed with presets for all required selectable functions:
a. Independent audio source selection from each remote control for its speaker zone (minimum of 5 preset source selections programmed per control)
b. Independent volume control from each remote control for its speaker zone
c. Parametric Equalization for audio input sources (Pre-EQ)
d. Filter settings (high pass)
e. Equalization to optimize loudspeaker frequency response for music/program zones.
f. Equalization to a standardized masking EQ curve for each masking zone output of the DSP.
g. Dynamics processing if required.

C. Network switch configuration
1. Configuration with owner supplied configuration document.

D. Audio music levels
1. All Speakers must have great sound quality free from background noise, static, or other noticeable interference.
a. Workout Floor Music – Must be intelligible 71dB SPL A weighted at 5.5 ft above floor.
b. General Areas, Corridors, Lockers, Cafe, Salon, Spa - Must be intelligible 71dB SPL A weighted at 5.5 ft above floor.

c. Paging Levels - Must be intelligible at a level of 80 dB SPL A weighted at 5.5 ft above floor.
d. Paging Horns - Must be intelligible at a level of 80 dB SPL A weighted at 5.5 ft above floor.
e. Misc. Speakers – Must be intelligible 71dB SPL A weighted at 5.5 ft above floor.

3.06 ADJUSTMENTS AND TESTS

A. The Contractor shall adjust and calibrate all system controls for standard operation, provide all programming of programmable equipment, set internal jumpers as required and completely test all system functions.

B. The Contractor shall completely test, calibrate and adjust all components as recommended by manufacturers.

C. The Contractor shall completely test all functions of the remote control system to verify proper operation and coordinate the testing with the Consultant and Owner Representative.

D. The Contractor shall equalize the loudspeaker systems, utilizing professional 1/3 octave real-time analyzer equipment and pink-noise generator and /or an approved audio measurement platform (TEF, EASERA, SMART Live).
1. Optimize the equalization of the loudspeaker zones for speech and music reproduction and provide all necessary programming of EQ filters to meet the designated (ref. D.1.a. below) EQ curve for each speaker system type (wall mounted, ceiling mounted).
a. The designated EQ curve to be used for the ambient sound system speaker systems shall provide flat (+-2 dB) response from 120 Hz to 4 Khz, with a high frequency rolloff of 3 dB per octave above 4 Khz to the natural response limits of the speaker devices. Apply parametric filters in cut mode, applying minimal boost only when gain reduction (cut) is not able to maintain the designated response curve. Provide up to 10 PEQ filters, applying as needed to maintain response curve.
b. Measure and apply equalization with one (1) speaker active within the specific room or zone to avoid phase related filtering of the response. Apply the final equalized PEQ settings to both DSP channels feeding stereo audio output to the measured room or zone.
c. Conduct a post EQ listening test in each room or zone, using music and speech audio program sources, in presence of designated Owner representative if/as elected by the Owner. Make final fine EQ adjustments if directed or required by Owner after listening tests.

3.07 INSTRUCTION OF OWNER

A. The contractor shall make available to the owner's representatives at least four (4) hours for demonstration and instruction in the use of the systems.

3.08 CLOSEOUT DELIVERABLES

A. Warranty statement document.

B. As-built architectural system drawings marked with redlines or finalized zone numbers/labels.

C. Q-Sys Designer Backup files.

D. IP Table with specific static IP’s are given by Life Time and should be noted in Excel format including all networked items with this information: Update and provide the following for each online device:
1. Device IP
2. Subnet Mask

3. Gateway
4. MAC Address
5. Switch Port
6. Switch Name
7. Usernames/ Passwords for each device documented if outside of Life Time standards.

E. Site photos
1. The contractor must provide site photos that are relevant to the individual room and job phase in a categorized digital format and file structure to Life Time upon completion of the project work.
2. Photos must include both close up and wide angle of all items as shown in scope. Label each picture and categorize folders for each area of facility.

F. Serial numbers for all equipment present in the final installation shall be presented to Life Time in a categorized digital format.
1. Make, model, serial number, and location.
2. Audio/visual rack mounted equipment make, model, serial number, and location.
3. Speaker systems make, model, serial number, and location.
4. Lighting equipment make, model, serial number, and location.
5. Temporary or portable, etc. audiovisual and DJ equipment make, model, serial number, and location.

G. As-built schematics
1. The contractor shall provide an as-built complete drawing set to Life Time upon completion of the assigned project work.
2. For all systems to include schematic/line drawings, floor plans, reflected ceiling plans and elevations.

3.09 FINAL CHECKOUT AND ACCEPTANCE

A. The Contractor shall verify that the system is complete and fully operational before requesting final approval and before scheduling system demonstration.

B. This Contractor shall be available to demonstrate the operation and use of the system to the Architect/Engineer and to the owner's representatives.

C. At the time of the demonstration, this Contractor shall furnish to the owner two (2) complete record manuals.

D. Final acceptance of the system will be given upon completion of all of the above requirements.

E. All components are free from dust, dirt, and fingerprints.

F. All components must be level, flush, and free from visible damage

3.10 MAINTENANCE SERVICE

A. This Contractor shall guarantee all equipment and workmanship to be free from defects for a period of one (1) year from substantial completion. The warranty period shall begin at the time of completion or at the time the Owner first receives beneficial use, whichever comes first.

B. When requested by Life Time within 12 months of date of Substantial Completion, provide on-site assistance for adjusting system to suit actual occupied needs and/or to maintain optimum system performance. Warranty issues shall be considered separately. Provide up to two visits to Project outside normal occupancy hours for this purpose. Include a minimum of 8 hours of on-site labor designated specifically for this purpose plus all necessary travel time. Any material costs and man-hours that extend beyond this provision may be billed to the owner provided such work and a prior cost estimate have been approved in advance by the owner.

END OF SECTION

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SECTION 27 25 00
AUDIO/VISUAL SYSTEMS AND DISPLAYS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General provisions of Contract including General and Supplementary Conditions and Division 1, specification sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK

A. This section is centered around TV Service (DirecTV/Cable TV) displays and independent Audio/Video Systems including standalone Audio systems.

B. Provide equipment and hardware to provide a complete integrated audio distribution system and sound masking system. Furnish all specified materials, products, installation labor, programming, and testing work required for a complete and fully functioning system. Equipment notated on BOM as “OFE” is owner furnished equipment by Life Time.
   1. Unless specified otherwise in the BOM, televisions, displays, digital signage PCs, portable sterio systems, music plays, and lighting systems are owner provided.

C. A conduit / raceway system required to support this equipment will be provided by others.

D. Programming and configuration documents, where applicable, are provided by LIfe Time.

1.03 DEFINITIONS

A. AV or A/V = Audio Video

B. AVC = Audio Video Contractor

C. BOM = Bill of Material

D. CAD = Computer aided design

E. DMX = Digital Multiplex

F. DSP = Digital Signal Processor (for Audio)

G. DSP = Digital Signage Player (for Digital Signage)

H. EC = Electrical Contractor

I. GC = General Contractor

J. GF = Group Fitness Studio

K. IDF = Intermediate Distribution Frame (Secondary IT Closet)

L. IT = Information Technology (For this document its referred to as a department)

M. LAN = Local Area Network

N. LTF Standards = Life Time Standards

O. LVC = Low Voltage Contractor

P. MDF = Main Distribution Frame (Main IT closet)

Q. Misc. = Miscellaneous

R. NEC = National Electric Code

S. OFE = Owner Furnished Equipment (By Life Time)

T. POE = Power Over Ethernet

U. QLAN = Q-Sys local area network

V. Q-SYS = Manufacturer “Q-Sys”

W. SPL = Sound Pressure Level

X. SOW = Scope of Work

Y. UL = Underwriters Laboratories (Safety Standards

Z. XLR = External Line Return (Style of Audio connector)

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Installer Qualifications, Certifications, and General Knowledge:
   1. CTS and Dante Certification by representative working directly on this project.
   2. Dante Certification.
   3. Training and experience with configuring Technicolor Com System.
   4. DirecTV dish certified installer.
   5. Experience with RF balancing on CATV systems.
   6. Experience using digital CATV meter to balance system.
   7. Experience with Bluebeam Revu, AutoCAD, Microsoft Windows 10, and Microsoft Office Suite.
   8. Network switch configuration experience including, but not limited to, IP addressing, QoS, VLAN, and DHCP.

C. Manufacturers
   1. The system shall be the product of the specified manufacturers, installed by an agency experienced in such work. The installation and connections of all equipment and tests of the operation of the system be made by a representative of the manufacturer or aforementioned installing agency.
   2. Contractor / integrator providing this system must be manufacturer approved to furnish, install, maintain, and warranty the system equipment specified.

D. Installation
   1. Installation of required raceways, conduits, and power receptacles shall be by the electrical contractor. The installation of communication outlets, wallplates, devices, and connections of all parts of the audio system shall be done by the A/V Contractor.

E. Programming
   1. The Contractor shall employ the services of an experienced system programming specialist for the Digital Signal Processor/Control system provided under this specification and an experienced programmer for configuring and programming the audio DSP processing equipment.

F. NEC Compliance
   1. Comply with NEC as applicable to construction and installation of system components and wiring.

G. UL Compliance
   1. Where required, provide system equipment which is UL listed and labeled.

H. Licensing
   1. The Communications Contractor shall be a low voltage contractor, licensed by the State of Minnesota.

1.05 SUBMITTALS

A. Product Data
   1. Submit manufacturers' data on all equipment, including:
      a. Detailed equipment list indicating the manufacturer, model number, and quantity for each equipment item being provided or existing item being re-installed.
      b. Manufacturer's product data sheets for each new equipment item.
      c. Dimensions, rough-in drawings, installation instructions, and operation and maintenance, suitable for inclusion in maintenance manual.

B. Shop Drawings
   1. Detailed wiring diagrams of the system. Diagrams shall show connection to each unit of system. Single-line block diagrams are not sufficient.
   2. Detail drawings of all custom fabricated panels, connection wallplates and associated components being supplied.
   3. Equipment rack elevation / layout diagrams (front face)

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prior to acceptance, OFE shall be inspected for damage. If damage on boxes, pallets, or equipment is visible, the shipments shall be rejected and sent back to logistics company. Communicate damage to Life Time AV representative.

B. Store products in manufacturer's packaging. Keep dry and protect from damage until ready for installation.

C. Equipment must be kept locked up at all times in either an on-site storage container provided by AV Installation contractor or within the building in a designated secure location.

D. Contractor shall not install any product in construction areas where the product is subject to damage from water, dust, and construction debris.

E. Contractor is responsible for their own tools and AV components that they are installing. Keep them secure at all times.

PART 2 PRODUCTS

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B. Coordinate with system block diagrams for verification of specific quantity of equipment items required in each system.

2.02 OWNER PROVIDED EQUIPMENT/MATERIAL (OFE)

A. Reference BOM for purchasing equipment. Do not provide items indicated as OFE.

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PART 3 EXECUTION

3.01 GENERAL

A. Wiring, except in equipment cabinets and where raceway or cable tray is provided, shall be routed open above suspended ceilings and in accessible walls and shall be in accordance with manufacturer's directions. All wiring in ceiling spaces shall be plenum rated. In accessible ceiling spaces, wiring shall be supported from ceiling structure at regular intervals of at least 48 inches. Cabling shall not be attached to or supported by ceiling tile support wires.

B. Final wiring connections shall be made and the entire system shall be tested and certified as working properly by an authorized representative of the Contractor. Written verification of test results shall be furnished to the Owner, Architect, and Engineer.

C. Identify and tag all cables with permanent type markers to denote location served.

D. All rack and in-cabinet wiring and cabling shall be neatly routed in plastic wiring duct or secured with tie wraps and routed along rack sides. All splices and connections shall be by plug, solder, or captive screw terminal strips, etc. Splices shall not hang in rack or cabinets.

E. All remotes, manuals, batteries, and spare cables shall be left in MDF Video Rack drawer.

3.02 INSTALLATION

A. Systems installation, cabling and rack building procedures shall fall in strict accordance with industry standards and manufacturer recommendations for safety and operation compliance.

B. Componentry installed during construction shall be either installed after finish carpentry and drywall sanding/construction is complete or covered in a method conducive to provide a dust free environment for the installed items if the possibility of damage could occur to the item prior to first use by the client.

C. Final installation measures by the AVC shall include cleaning components to eliminate fingerprints, dust, or debris during the installation phase. Additional cleaning required by Life Time prior to first use by client will incur a cleaning fee payable by the AVC.

D. Install all equipment, components, accessories, terminal blocks, connectors and hardware necessary to provide a complete and operational system. Connector types and quantities shown in the drawings are representative and the Contractor shall be responsible to supply any additionally required connectors and wiring. Connectors shall be provided and installed as recommended by the manufacturer of the terminating equipment. All other wiring connections to connectors mounted on input plates and floor boxes shall be soldered connections or crimp (video) connections.

E. Provide and coordinate integration of this equipment with the CATV cabling distribution system specified under appropriate Division 27 specification section(s) and as indicated in the drawings.

F. All interconnects must be tied neatly with Velcro ties every 12”.

G. Zip ties are not allowed.

H. Cable minimum bend radius after installation shall be no less than 10 times the cable diameter.

I. MDF and IDF equipment racks

1. All MDF and IDF equipment racks shall be bolted to the concrete floor by the AVC by appropriate means and hardware relative to the application. Please consult local building safety codes and GC requirements.
2. Seismic locations may require addition iso-base equipment application prior to permanently affixing equipment or server rack cabinets.
3. Follow OFE rack layout for equipment layout in rack.
4. All MDF and IDF equipment rack enclosures shall be properly grounded and bonded to the electrical earth grounding system as specified in the NEC. Please consult with the project EC to determine wire size and additional requirements.
5. The audio rack layout shall provide for power conditioning and amplifiers stack neatly at the lower end and follow with DSP, AV network devices, baluns etc. to the top with a blank rack panel between each separate component type. Appropriate thermal management shall be employed as required.
6. All cables shall have labels which depict source and destination which are clearly labeled and visible as stated above in item - 11. Cable Labeling Standards.
7. Network cabling from patch panel follow network cable color scheme:
    a. Purple depicts all QLAN.
    b. Green depicts AV items.
8. AV network switches – Netgear.
9. Do not exceed POE allowances.
10. Cable management shall be neat, organized, and stress free. Strict adherence to the Avixa Rack Building for Audio Visual Systems Standard is required. Items bulleted below must be calculated and applied in the rack building process.
    a. Velcro cable strap support every 12” (the use of nylon wire ties is prohibited).
    b. Strain relief
    c. Service loops
    d. Horizontal cable management
    e. Vertical cable management
11. Equipment rack thermal management shall be employed to ensure a nominal temperature of no more than 75 degrees Fahrenheit.
12. MDF to IDF interconnection runs shall be over fiber as Q-Lan.
13. Group fitness racks provided by others.
    a. Barre, Pilates, Yoga, Others etc. Small format racks built, populated, and installed/commissioned by AVC.

J. Satellite systems
1. DirecTV is the preferred satellite system vendor for Lifetime installations.
2. New Satellite account information will be supplied and activated by Life Time. The AVC will coordinate and supply the dish installation. Dish installation must be done to DirecTV standards and includes, but is not limited to the following:
    a. Provide 8x8x16 cinder blocks for non-penetration roof mounts.
    b. Non-penetration mount shall have a rubber mat between rooftop and dish mount.
    c. Provide dish grounding to DirecTV standards.
    d. Terminations must include dielectric grease.
    e. Must include drip loops.
3. The LVC provides terminal feeds from the MDF to satellite dish/LNB. Connect cabling to Dish.
4. DIRECTV signal is modulated onto RF channels which are then displayed via set top boxes at each cardio display.

5. All display, head end, and set top boxes are provided by Sonify as well as the satellite dish, LNB/LNA, and satellite dish roof mount.
6. Dish signal strength must be free from obstructions.

K. Cable TV systems
1. New cable TV services will be supplied and activated by Life Time.
2. The AVC will provide and connect coaxial cable feeds from cable TV system with MDF to Video Rack.

L. Display (TV) mounting procedures
1. Wall Mount:
a. Wood or metal stud wall covered with gypsum board (drywall) the studs shall be a minimum of 2" x 4" nominal size. Do not install over gypsum board with a thickness greater than 5/8".
1) The structural wall is required to be able to support five times the load of mounted display and equipment.
b. Solid concrete
1) The wall shall be at least 8" thick with a minimum compressive strength of 2000 psi. The cinder blocks shall meet ASTM (American Society for Testing and Materials) C-90 specifications and have a minimum nominal width of 8". Mortar joints are not approved to be used for mounting displays or other materials in any case.
2) The structural wall is required to be able to support five times the load of mounted display and equipment.
c. Cinder block wall
1) The cinder blocks must meet ASTM C-90 specifications and have a minimum nominal width of 8”. Mount securely in a solid portion of the block, generally 1" (25 mm) minimum from the side of the block. A standard electric drill on slow setting shall be used to drill the hole in lieu of a hammer drill to avoid breaking out the back of the hole when entering a void or cavity. The installer shall not attach concrete expansion anchors to concrete or cinder block covered with drywall or other finishing material.
2) The structural wall must support five times the load of mounted display and equipment.
d. Components behind TV including, but limited to, TV tuner, digital signage PC, or power conditioners must be strapped to wall and accessible to service from side of TV without having to remove display to access.
e. Cabling/adapters must not be visible and tied with Velcro.
2. Ceiling pole mount for TVs, projectors, or others
a. Ceiling pole mounts shall utilize a combination of a ceiling plate adapter directly anchored to the deck/ceiling or securely fastened to uni-strut utilizing a combination of spring nuts, threaded rod, and the appropriate combinations of machine nuts and washers.
b. Adapter plates shall have a 6x6 hole pattern and withstand five times the load of the mounted display and equipment.
c. Uni-strut channel shall be mounted securely by either spanning and passing through structural members attached with beam clamps or directly shot into the deck/ceiling with the appropriate fastener. The two end points of the uni-strut channel must pass through structural members to ensure stability and proper load dispersion.

d. Back-to-back display mounting applications shall follow also follow the above specifications and the manufacturers' direct specifications for sway and weight ratio.
e. The mounting of electronic DSP (Digital Signage Player) installation location shall be strapped to the back of the mounted display device and accessible for serviceability.
f. Routing of audio-visual cables shall be neatly tucked into the extension pole or run through a flex material and strapped to the extension pole.
g. Projectors must be mounted flush with top of visible screen.

3. Millwork display mounting
   a. Flat panel displays mounted in millwork shall be directly coordinated with the architectural millwork drawing set. The display mount shall be fastened securely to the millworkers supplied backing and a minimum air gap of no less than six inches shall be observed on all sides for adequate display heat dissipation/ventilation.
   b. In complete enclosure applications, proper thermal management practices shall be required to always keep display and electronics temperature within the sealed/trimmed enclosure to no more than 80% of the maximum allowable operating temperature per the individual manufacturer's specifications. Exhaust fans and temperature sensors shall be utilized to ensure safe operating conditions and electronic equipment operational longevity that does aid to harm or void the manufacturers equipment warranty.
   c. The structural wall must support five times the load of mounted display and equipment.
   d. The mounting of electronic DSP and tv tuner and installation location shall be behind the display device mounted to the internal structure of the millwork enclosure.
   e. Routing of audio-visual cables shall be tucked neatly behind the display device and strapped with strain relief and allow for removal of the display device prior to cable disconnection. Visible or unmanaged cables shall not be permitted.

M. Projectors
1. Ceiling mounted projectors must follow pole mounted structural requirements above.
2. Projector positioning and height must be calculated based on throw distance and approved by Life Time AV representative.
3. Projector image must fill screen exactly with no keystone or stretching allowed.
4. Projectors must be level
5. Projectors must be 8ft above floor.
6. Projector ceiling storage boxes must be used, include power within, and no wires visible routing up pole to ceiling storage.

N. Projector screens
1. Projector screens must be secured via manufacturer directions/hardware requirements.
   a. Must be secured to ceiling or walls.
2. Projector screens must be adjusted to be within 1" of overhead case, unless AV representative approved.

O. Standalone audio/video systems (i.e. Group Fitness, Cycle, Yoga, Barre, Stereo/Video Systems)
1. Racks must follow wiring and rack layouts.
2. Devices must be accessible on networks as shown on drawings. Follow IP information and give MAC addresses.
3. Programming provided by Life Time. Provide minor adjustments such as labels and levels.

P. Portable systems

1. Receive owner provided portable systems at facility and secure.

Q. Bluetooth
1. Bluetooth must not have interference with any other wireless device. Must work within 30 ft per manufacturer specifications. Notify Life Time AV representative if interference cannot be mitigated.

R. Interconnects and Cabling Specifications
1. DMX lighting control cabling
   a. All DMX cabling shall conform to ANSI e1.27-2-2009 (r2014), recommended practice for permanently installed control cables for use with ANSI e1.11 (DMX512-a) and USITT DMX 512/1990 products.
   b. The maximum total length of a daisy-chain DMX control run is 300 meters (1,000 feet) using the lowest grade cabling conforming to ANSI e1.27-2-2009 (r2014). Improved wire gauge and shielding can extend this limitation.
   c. Some additional devices such as repeaters or splitters may also extend this limitation. Consult manufacturer to validate any limitation extensions.
   d. Every DMX control run must be terminated after the last DMX control module in a daisy-chain sequence with a DMX terminator. All cables shall be UL listed type cmp (plenum) or cm/cmr (non-plenum) as required.
   e. All cables shall meet or exceed the following performance requirements:
      1) Nominal impedance: 120 ohm
      2) Nominal outer jacket OD of 0.271”
      3) Meet or exceed USITT standards for DMX 512 cabling specifications
      4) Core conductor AWG - 24AWG (7x32) stranded tc
      5) (4) conductor cable with foil and tc braid
      6) Insulation type foam pe, .025” wall
      7) Drain wire 24AWG (7x32) stranded tc
      8) Termination connectors shall be Nuetrik DMX 3 pin m/f
2. HDMI interconnection cables
   a. All HDMI interconnect cabling shall comply with the HDMI 2.1 specification developed by the HDMI consortium.
   b. All cables shall meet or exceed the following performance requirements:
      1) Frame rate: 24, 25, 30, 50 or 60fps
      2) Chroma sampling: 4:4:4, 4:2:2, or 4:2:0
      3) Bit color depth: 8 bits per color
      4) Signal type: HDMI 2.0
      5) Max video data rate: 18.0 gbps (6.0 gbps per color)
      6) Resolution range: up to 4k @ 60 Hz (4096x2160), uhd @ 60 Hz
      7) 8-bit color depth, max. 18.0 gbps data rate
      8) Voltage: 30v
      9) Pair impedance: 100 ohms +/- 10 ohms
      10) Attenuation:
         (a) At 0.3 – 0.825 GHz ≤5 dB per 3 m
         (b) At 0.825 - 2.475 GHz: ≤12 dB per 3 m
         (c) At 2.475 - 4.125 GHz: ≤20 dB per 3 m
         (d) At 4.125 - 5.100 GHz: ≤25 dB per 3 m
      11) Fext: ≥20 dB per 3 m
      12) Skew:

(a) Intrapair: ≤112 ps per 3 m
(b) Intrapair: ≤1.78 ns per 3 m

3. Display port interconnection cables
   a. All cables shall meet or exceed the following performance requirements:
      1) Frame rate: 24, 25, 30, 50 or 60fps
      2) Chroma sampling: 4:4:4, 4:2:2
      3) Bit color depth: 8, 10 or 12 bits per color
      4) Signal type: DisplayPort 1.2, HDCP 1.4, HDCP 2.3
      5) Max video data rate: 21.6 gbps (5.4 gbps per lane)
      6) Resolution range: up to 4k @ 60 Hz (4096x2160), uhd @ 60 Hz
      7) 12-bit color depth, max. 21.6 gbps data rate
      8) Voltage: 40v
      9) Pair impedance: 100 ohms +/- 10 ohms
      10) Attenuation:
         (a) At 0.3 – 0.825 GHz ≤5 dB per 3 m
         (b) At 0.45 - 1 GHz: ≤7.7 dB per 3 m
         (c) At 1 - 2 GHz: ≤12.6 dB per 3 m
         (d) At 2 - 3 GHz: ≤17.5 dB per 3 m
         (e) At 3 - 4 GHz: ≤22.4 dB per 3 m
         (f) At 4 - 5 GHz: ≤27.3 dB per 3 m
         (g) At 5 - 7 GHz: ≤37.1 dB per 3 m
         (h) Fext: ≥20 dB per 3 m
         (i) Skew:
            (1) Intrapair: ≤50 ps per 3 m
            (2) Intrapair: ≤4 ns per 3

3.03 IDENTIFICATION AND LABELING

A. Each cable related to AV equipment must be labeled on each end. This includes, but is not limited to:
   1. Speaker cables
   2. Power cables
   3. Network cables
   4. Audio cables

B. Cable labeling shall follow the Avixa/Infocomm F501-01:2015 Cable Labeling for Audiovisual Systems printed standard.

C. Adaptation of other standards shall not be permitted unless specifically stated in writing by an authorized Life Time representative.

D. Each unique identifier (primary data element) should have a prefix and/or suffix determined by the accompanying project documentation.

E. Examples:
   1. Signal type • Cable type designation
   2. Room/floor/building number
   3. Location designation of cables
   4. Review and adhere to the standard as compliance is mandatory throughout.

3.04 TOOLS AND MATERIALS REQUIRED

A. Provide the following, including, but not limited to:

1. Safety equipment including hard hats, safety vests, steel toe boots, and eye protection.
2. Ladders
3. Scissor lift
4. Lockboxes and storage boxes
5. Hand tools
6. Termination tools
7. Hardware and screws
8. Anchors and ceiling support wires
9. Misc. materials/tools as needed to complete scope of work.

3.05 PROGRAMMING AND COMMISSIONING

A. General
   1. Provide all initial setup and programming required for operation of the digital signage server including coordinating and testing network connectivity and web-based accessibility and shall utilize manufacturer provided assistance as needed and available.

B. Digital Signage
   1. Digital Signage players provided by Life Time are pre-programmed. Confirm these players are connected to the Life Time Cisco Network and are accessible by Life Time digital signage team.
   2. Coordinate with Life Time Digital signage team to align aspect ratio and naming.

C. Audio Fetch
   1. Audiofetch listening device(s) must be programmed to Life Time channel lineup.
   2. All TV audio must be balanced on member app during configuration.
   3. Audio must be calibrated for delay to minimize delay between audio and video.

D. Technicolor COM system (for DirecTV satellite distribution)
   1. Configure COM system to LIfe Time standards.
   2. HD programming must follow Life Time provided channel lineup.
   3. HD Channels must be programmed with IP information provided, live on Life Time internal network.
   4. Licensing must be applied per channel.
   5. Each QAM Carrier must be enabled with “Clear HD”, also known and “In the Clear”.
      a. Coordinate the approval process with Technicolor and DirecTV. Life Time will provide the signed paperwork with grandfathered agreement with DirecTV.
   6. Output of COM system “QAM” coax output must be measured between +30dBmV and +50dBmV.
   7. Electronic programming guide channel should be activated but NOT included in channel lineup. Program guide to include channel information to be broadcasted to cardio equipment and TV tuners.

E. TV settings
   1. Each TV should be set to operate 24/7. Follow these settings:
      a. TVs must be set with auto-off disabled.
      b. Set time on each display.

F. TV tuners
   1. Follow the owner provided configuration documentation for initial setup

2. Life Time will provide the desired Channel TV lineup with QAM channel numbers broadcasted from TV distribution. Provide coordination with Life Time AV representative to verify subscriber network channels to be deleted for inserting local channels and determining channels for channel elimination filters. The channel lineup indicated on the drawings shall be verified by the contractor and coordinated with the owner.
3. Close captioning must be visible on large TVs.
4. Channel information and TV channel numbers shall be visible on TV tuner.

G. Programming cardio equipment TV tuners
1. Each TV attached or built in, with RF distribution, must include every channel in channel lineup. Must be clear from static, pixelization, and other interference.
2. Audio must be verified at each piece of equipment with headphones. Clear from any static or glitching.
3. Closed captioning must be visible upon demand on each TV.

H. Projectors
1. Projectors must fill entire screen.
2. Set to auto-off after four (4) hours.

I. Wireless microphone systems
1. Wireless microphone systems must not interfere with other wireless devices in the facility or outside. Frequency scans must be performed to ensure no interference.

J. Portable audio systems
1. Each must be setup, tested for audio, wireless mic configured for facility, and no interference.

3.06 ADJUSTMENTS AND TESTS

A.

B. The Contractor shall completely test, calibrate, and adjust all components as recommended by manufacturers.

C. The Contractor shall completely test all functions of the remote control system to verify proper operation and coordinate the testing with the Consultant and Owner Representative.

3.07 INSTRUCTION OF OWNER

A. The Contractor shall provide Owner user training on all operational aspects of new equipment provided for the system and shall provide up to eight (8) hours of instruction (in conjunction with manufacturer) for operation of the new video messaging system. Training information, sign-in sheets shall be included in as-built documentation.

3.08 CLOSEOUT DELIVERABLES

A. Warranty statement document.

B. As-built architectural system drawings marked with redlines or finalized zone numbers/labels.

C. TV tuner cloned image backup file(s).

D. IP Table with specific static IP’s are given by Life Time and should be noted in Excel format including all networked items with this information: Update and provide the following for each online device:
1. Device IP
2. Subnet Mask
3. Gateway
4. MAC Address

5. Switch Port
6. Switch Name
7. Usernames/ Passwords for each device documented if outside of Life Time standards.

E. Site photos
1. The contractor must provide site photos that are relevant to the individual room and job phase in a categorized digital format and file structure to Life Time upon completion of the project work.
2. Photos must include both close up and wide angle of all items as shown in scope. Label each picture and categorize folders for each area of facility.

F. Serial numbers for all equipment present in the final installation shall be presented to Life Time in a categorized digital format.
1. Display/television make, model, serial number, and location
2. Audio/visual rack mounted equipment make, model, serial number, and location.
3. Lighting equipment make, model, serial number, and location.
4. Temporary or portable, etc. audiovisual and DJ equipment make, model, serial number, and location.

G. As-built schematics
1. The contractor shall provide an as-built complete drawing set to Life Time upon completion of the assigned project work.
2. For all systems to include schematic/line drawings, floor plans, reflected ceiling plans and elevations.

H. Each wireless microphone system frequency in Excel and photos.

3.09 FINAL CHECKOUT AND ACCEPTANCE

A. The Contractor shall verify that the system is complete and fully operational before requesting final approval and before scheduling system demonstration.

B. This Contractor shall be available to demonstrate the operation and use of the system to the Architect/Engineer and to the owner's representatives.

C. At the time of the demonstration, this Contractor shall furnish to the owner two (2) complete record manuals.

D. Final acceptance of the system will be given upon completion of all of the above requirements.

E. All components are free from dust, dirt, and fingerprints.

F. All components must be level, flush, and free from visible damage

3.10 MAINTENANCE SERVICE

A. This contract shall include a written warranty for the installed system, including all equipment and workmanship, as a guarantee to correct any defects and failures for a period of 12 months. The warranty period shall begin at the time of completion (fully tested and accepted) or at the time the owner first receives beneficial use, whichever comes first. Within this 12 month warranty period, the entire system shall be kept in proper operating condition at no charge to the Owner.

B. When requested by owner within 12 months of date of Substantial Completion, provide on-site assistance for adjusting system to suit actual occupied needs and/or to maintain optimum system performance. Warranty issues shall be considered separately. Provide up to two visits to Project outside normal occupancy hours for this purpose. Include a minimum of 8 hours of on-site labor designated specifically for this purpose plus all necessary travel time. Any material costs and man-hours that extend beyond this provision may be billed to the owner provided such work and a prior cost estimate have been approved in advance by the owner.

END OF SECTION

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SECTION 27 41 33
BROADBAND TELEVISION DISTRIBUTION SYSTEM

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 SECTION INCLUDES

A. Broadband Television Distribution System: Equipment, coaxial cabling, and components configured for the distribution of television signals.

1.03 DEFINITIONS

A. Agile Receiver: A broadband receiver that can be tuned to any desired channel.

B. 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.

C. 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.

D. 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.

E. CEA: Consumer Electronics Association.

F. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. dBmV = 20 log 10(V1/V2) where V1 is the measurement of voltage at a point having identical impedance to V2 (0.001 V across 75 ohms).

G. 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.

H. MATV: Master antenna television; a small television antenna distribution system usually restricted to one or two buildings.

I. RF: Radio frequency.

1.04 SYSTEM DESCRIPTION

A. The system shall consist of a DirecTV or Cable TV service transmitted over a a coaxial cable distribution system.

B. Headend equipment shall consist of receiving antennas and associated signal amplification and equalization.

C. Distribution of DirecTV or Cable TV service signals. 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, 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.

E. Hardware Requirements: Use modular, plug-in, solid-state electronic components. Mount amplifiers and other powered equipment in head end racks.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. 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.
   2. Source quality-control test reports on coaxial cable sweep tests.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For head-end 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. Operating Instructions: Provide two sets. Furnish instructions so the users of the system will know how to fully operate the system.
   3. As-Built Drawings: Provide one set. These drawings shall include any changes made to the system during installation. Include circuit diagrams and other information necessary for the proper operating and maintenance of the system.
      a. Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.
   4. Include all warranty information as specified.

D. Record Documents and Drawings:

E. This contractor shall furnish to the Owner two (2) complete as-built manuals. These manuals shall be assembled in a loose-leaf binder and shall contain the following:
   1. System Operating Instructions
   2. System Functional Block Diagram(s)
   3. System Schematic Diagram(s)
   4. Component Operating Manual(s)
   5. Component Service Manual(s)
   6. System Wiring List(s)

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

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. Comply with NECA 1.

D. Comply with NFPA 70 (National Electrical Code).

E. UL Compliance: Provide equipment and components that are UL listed and labeled.

1.07 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 DirecTV or Cable TV service provider.

1.08 GUARANTEES AND WARRANTIES

A. This contract shall include a written warranty for the installed system, including all equipment and workmanship, as a guarantee to correct any defects and failures for a period of 12 months. The warranty period shall begin at the time of completion (fully tested and accepted) or at the time the owner first receives beneficial use, whichever comes first. Within this 12-month warranty period, the entire system shall be kept in proper operating condition at no charge to the Owner.

1.09 MAINTENANCE SERVICE

A. System Adjustments: When requested by owner within 12 months of date of Substantial Completion, provide on-site assistance for adjusting system to suit actual occupied needs and/or to maintain optimum system performance. Warranty issues shall be considered separately. Provide up to two visits to Project outside normal occupancy hours for this purpose. Include a minimum of 8 hours of on-site labor designated specifically for this purpose plus all necessary travel time. Any material costs and man-hours that extend beyond this provision may be billed to the owner provided such work and a prior cost estimate have been approved in advance by the owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: All listed manufacturers are subject to compliance with the requirements specified herein.

B. Equipment shall be made by manufacturers listed herein are considered approved for bidding on this project. Where specific makes and models are referred to, the intention is to establish a minimum level of performance and features. Materials shall never be ordered based solely upon model numbers, but rather foremost upon specifications, descriptions, and applications of such materials. Any perceived inconsistencies shall be discussed with the Life Time AV representative prior to bid.

C. Any equipment or materials proposed as equivalent to the system herein specified, must be so proven by the contractor. Provide manufacturer's name, model numbers, and two (2) copies of product data documentation. Once such information is provided, the alternate manufacturer may be approved only by the specifying authority. Alternate manufacturers are allowed only after the specifying authority modifies this contract (via addendum) to include such manufacturers as equivalents.

2.02 SUBSTITUTIONS

A. The contractor shall submit proposed alternates to the Life Time AV representative at least ten (10) working days prior to the bid date.

2.03 BROADBAND EQUIPMENT

A. Description: Signal-source components, signal-processing 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. Equipment shall translate UHF channels to VHF channels before distribution to outlets.

B. Identification of Signal Sources and Channels Distributed: Coordinate all such information directly with the owner and their signal service provider.

C. Broadband System Qualitative Performance Requirements: Reception quality of color-television program transmissions at each system outlet from each designated channel and source shall be equal to or superior than that obtained with performance checks specified in Part 3 "Field Quality Control" Article, using a standard, commercial, cable-ready, color-television receiver.

D. Broadband 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.

2.04 BROADBAND HEAD-END COMPONENTS

A. Manufacturers:
1. Blonder Tongue Laboratories, Inc.
2. Cabletronix, Inc.
3. Technicolor
4. ZeeVee

B. Head-end Equipment: Channel mixers, processors for channel translation, broadband amplifier, single-channel amplifiers, and/or combining networks for receiving off-air television and FM signals and outputting the signals to cable distribution system. Equip coaxial down leads of the off-air antennas with preamplifiers to send signals at strength required by head-end.
1. House the units in within the head end rack.
2. All head-end equipment shall be 19" rack mountable in the floor-mounted rack(s).

C. Broadband Amplifier:
1. Frequency Range: 47 to 860 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.
6. Design Basis: Broadband Indoor Distribution Bi-directional Amplifier, 47-860 MHz frequency range, Blonder Tongue RMDA series or approved equivalent. Determine quantity and size as required for proper signal level.

2.05 DISTRIBUTION COMPONENTS

A. Cable Fittings shall be male F-connectors designed specifically for the specified RG-6/11 and ½" hard-line cable. Manufacture of cable fittings shall be Gilbert, LRC, or approved equivalent.
1. Type F, 75 ohms.
2. Compression-type cable fitting.
3. Anti-corrosion nickel-plated finish.

B. Couplers (or taps) for connections of coaxial signal distribution in telecommunication rooms shall have bandwidth performance of 5 to 1000 MHz, be available in 2-way to 8-way configurations, be available in attenuations from 8-30 dB (provide appropriate attenuation to meet design and signal distribution requirements, and have 120 dB RFI shielding. Approved manufacturers are Cable Tronix, Blonder-Tongue, or approved equivalent.

C. Splitters for distribution of coaxial backbone cabling shall have bandwidth performance of 5 to 1000 MHz, be available in 2-way to 8-way balanced configurations (or 3-way unbalanced), and have 120 dB RFI shielding. Provide splitters as required to meet signal distribution requirements. Approved manufactures are Cabletronix, Blonder-Tongue, or approved equivalent.

D. All cable fittings shall be compression-type with anti-corrosion nickel-plated finish.

E. Provide Type-F terminating resistors for all unused taps of splitters and directional couplers.

F. Cable System Power Supplies: Plug-in modular construction, with surge, short circuit, and overload protection.

G. Signal Traps: Packaged filters tuned to interference frequencies encountered in Project.

H. Attenuators: Passive, of fixed value, used to balance signal levels.

I. User-Interface Device: Flush, female-type outlets, designed for installation in data faceplate, mounting in standard outlet box, with metallic parts of anodized brass, beryllium copper, or phosphor bronze.
   1. Cable Connector: Female, Type F. Insert to be pass-thru RF-Type connector for mating with F type male connectors.
   2. Wall Plates: specified in section 271350
   3. Attenuation: Less than 0.1 dB.
   4. Voltage Standing-Wave Ratio: Less than 1.15 to 1.

2.06 COAXIAL CABLING

A. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband CATV and data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB minimum from 5 to 1000 MHz, and shall be listed to comply with NFPA 70, Articles 810 and 820.

B. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
   1. CATV Cable: Type CATV or CATVR.
   2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
   3. CATV Riser Rated: Type CATVR, complying with UL 1666.
   4. CATV Limited Rating: Type CATVX.

C. Indoor RG6 Cable shall comply with the following requirements:
   1. Type RG6, quad shielded with CL2P jacket.
      a. Nominal impedance: 75 ohm +/-3.0 Ohm
      b. Nominal velocity of propagation: 83%
      c. Nominal capacitance: 16.2 pf/ft. (53.1 pf/m)
      d. Temperature rating: -40ºc +80ºc temp
      e. Core AWG: 18
      f. Nominal core o.d.: 0.180in (4.57mm)
      g. Nominal o.d.: 0.275 in (6.99 mm)
      h. Nominal delay: 1.24 ns/ft
      i. Nominal conductor dc resistance 20ºc: 28.0 / 1000 ft.
      j. Structural return loss:
      k. 23 dB min, 5-85 MHz
      l. 21 dB min, 851-3000 MHz
   2. Nominal attenuation:
      a. 1.0 MHz - 0.24dB/100 ft
      b. 3.6 MHz - 0.45dB/100 ft
      c. 10.0 MHz - 0.72dB/100 ft
      d. 71.0 MHz - 1.70dB/100 ft

e. 135.0 MHz - 2.10dB/100 ft
f. 270.0 MHz - 2.97dB/100 ft
g. 360.0 MHz - 3.43dB/100 ft
h. 720.0 MHz - 4.95dB/100 ft
i. 1000.0 MHz - 5.89dB/100 ft
j. 3000.0 MHz - 10.67dB/100 ft

3. Attenuation per 100 feet shall not exceed 7.3 dB at 1000 MHz.
4. Plenum rated, UL Listed type CMP marking on cable.
5. Product identifications markings at regular intervals on cable
6. White in color (cable jacket) unless noted otherwise
7. Approved products:
   a. CommScope #7461604
   b. Equal by West Penn
   c. Equal by Belden
   d. Or prior approval.

D. Outdoor RG6 Cable shall comply with the following requirements:
1. Type RG6, quad shielded with sunlight resistant rated jacket.
2. Nominal impedance: 75 ohm +/-3.0 Ohm
   a. Nominal velocity of propagation: 83%
   b. Nominal capacitance: 16.2 pf/ft. (53.1 pf/m)
   c. Temperature rating: -40ºc +80ºc temp
   d. Core AWG: 18
   e. Nominal core o.d.: 0.180in (4.57mm)
   f. Nominal o.d.: 0.275 in (6.99 mm)
   g. Nominal delay: 1.24 ns/ft
   h. Nominal conductor dc resistance 20ºc: 28.0 / 1000 ft (about 304.8 m).
   i. Structural return loss:
   j. 23 dB min, 5-85 MHz
   k. 21 dB min, 851-3000 MHz
3. Nominal attenuation:
   a.
   b. 3.6 MHz - 0.45dB/100 ft
   c. 10.0 MHz - 0.72dB/100 ft
   d. 71.0 MHz - 1.70dB/100 ft
   e. 135.0 MHz - 2.10dB/100 ft
   f. 270.0 MHz - 2.97dB/100 ft
   g. 360.0 MHz - 3.43dB/100 ft
   h. 720.0 MHz - 4.95dB/100 ft
   i. 1000.0 MHz - 5.89dB/100 ft
4. 3000.0 MHz - 10.67dB/100 Attenuation per 100 feet shall not exceed 7.3 dB at 1000 MHz.
5. Product identifications markings at regular intervals on cable.
6. Black in color (cable jacket).
7. Approved manufacturers:
   a. CommScope
   b. West Penn
   c. Belden
   d. Or prior approval.

E. Indoor RG11 Cables shall comply with the following requirements:
   1. Type RG11, quad shielded with CL2P jacket.
   2. Nominal impedance: 75 ohms.
      a. Nominal velocity of propagation: 84%
      b. Nominal capacitance: 16 pf/ft. (53.1Pf/m) temperature rating: -40ºc +80ºc
      c. Core AWG: 14
      d. Nominal core o.d.: 0.064in
      e. Nominal o.d.: 0.400 in
      f. Nominal delay: 1.21 ns/ft
      g. Nominal conductor dc resistance 20ºc: 25 /1000 ft.
   3. Structural return loss:
      a. 23 dB min, 5-85 MHz
      b. 21 dB min, 851-3000 MHz
   4. Nominal attenuation:
      a. 1.0 MHz - 0.16dB/100 ft
      b. 3.6 MHz - 0.29dB/100 ft
      c. 10.0 MHz - 0.46dB/100 ft
      d. 71.5 MHz - 1.09dB/100 ft
      e. 135.0 MHz - 1.47dB/100 ft
      f. 270.0 MHz - 2.09dB/100 ft
      g. 360.0 MHz - 2.45dB/100 ft
      h. 720.0 MHz - 3.58dB/100 ft
      i. 1000.0 MHz - 4.30dB/100 ft
      j. 3000.0 MHz - 8.20dB/100 ft
   5. Attenuation per 100 feet shall not exceed 4.3 dB at 1000 MHz.
   6. Plenum rated, UL Listed type CMP marking on cable.
   7. Product identifications markings at regular intervals on cable.
   8. White in color (cable jacket).
   9. Approved manufacturers:
      a. CommScope
      b. West Penn
      c. Belden or prior approved equivalent.
      d. Or prior approval.

F. Coaxial trunk cable from the main telecommunications room to telecommunications rooms shall comply with the following requirements:
   1. Trunk and distribution coaxial cable.
      a. Copper-clad aluminum wire covered with foam FEP dialectic aluminum tube shield and PVC jacket; overall cable diameter of 0.536 inches.
      b. Nominal impedance 75 ohm
      c. Attenuation per 100 feet shall not exceed 3.78 dB at 1000 MHz.
      d. Plenum rated. UL Listed type CMP marking on cable.
      e. Product identifications markings at regular intervals on cable.
      f. White in color (cable jacket).
      g. Approved products:
         1) CommScope #2312V
         2) West Penn equal.
         3) Belden equal.

4) Or prior approval.

G. Station Cords:
1. For each user-interface device installed, provide a 10-foot (or other length as noted) RG-6/U 18 AWG coax cable terminated at both ends for connection to owner-provided audio/video electronics.

PART 3 EXECUTION

3.01 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 walls, floors, roofs, equipment bases, and roof supports for suitable conditions where television equipment is to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL REQUIREMENTS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, casework, and in accessible ceiling spaces. Conceal raceway and cables except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Install cables concealed in accessible ceilings, walls, and floors wherever possible.

B. Supporting Cables: All cabling supports installed on this project shall be installed in a manner that results in all cabling being routed parallel and/or perpendicular with adjacent building lines (walls, floors, and structural elements). Cables flown above ceilings diagonally or angles other than 90-degrees or 0-degrees relative to adjacent building lines will not be accepted. Non-compliant installations shall be removed and reinstalled at the expense of this contractor. Do not run adjacent and parallel to power or data cables.

C. Cable and wiring shall not lay loose on ceiling tiles or grids.

D. 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.

E. Support cables with Velcro straps. Vinyl cable ties are prohibited.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Where manufacturer's torque tightening requirements are not indicated, tighten connectors and terminals to comply with tightening torques per NEC specifications.

G. Grounding: According to recommendations in IEEE 142 and IEEE 1100.

H. Install coaxial cables in telecommunications cable trays where permissible; place coaxial cables separated away from voice and data cabling. When coaxial cables are not support in cable tray or conduit, provide a separate J-hook support system.

I. Follow manufacturer’s installation instructions for the installation of coaxial cable. Trunk cable shall not bend of 20 times the cable diameter (approximately 11-inch maximum bend radius).

J. Terminate RG-6 cables at TV outlet locations with F-connectors and connected to faceplate feed-through couplers installed in faceplates.

K. Connect all coaxial cable on couplers, splitter, and amplifiers so the coaxial cabling system is ready to distribute input signals with clear images at all TV outlet locations in the building.

L. TV outlet locations shall be clearly labeled and identified on the as-built drawings.

M. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.

N. Cable may not be installed in same raceway with power cable.

O. Coaxial cable shall not be spliced except on plywood backboards in wire closets or in cabinets designated for the purpose.

P. Do not use water-based cable pulling lubricants with PVC-jacketed cable.

Q. Do not exceed manufacturer's recommended minimum bending radiuses.

R. 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.

S. Cable Support: Install supports at intervals recommended in writing by cable manufacturer. Install supports within 6 inches (150 mm) 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.

T. 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.

U. 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.

V. Provide a 75ohm terminator cap at every jack. Tighten each with a wrench until snug.

3.03 MDF AND FACILITY WIDE RF SYSTEM

A. Provide taps/splitters/attenuators/amplifiers in all locations shown on Technology Prints. (NOTE: Drawing is a basic guide based off of estimated distances. Actual distances depend on cable pathways and other variables. Results could vary and minor changes of tap/splitters/amplifiers/attenuators may need to take place. Please take this into consideration. Find best suitable technician with broad range of knowledge on RF distribution to complete work and before all hardware is purchased. Any changes to drawing will first need to be consulted with Life Time AV representative representative).
   1. All splitters/taps shall be anchored to a solid surface using anchors/zip ties or other means. No Splitter/tap/attenuator shall be visible.
   2. Soffit TV taps shall be installed on soffit shelf adjacent to each TV.
   3. Tighten all F connectors with wrench until snug.

B. In MDF: Install all Splitters/Amplifiers on Wall behind Video Rack(s).
   1. Provide custom made, short black RG6 quad jumpers terminated with F connectors for the interconnects between all pieces on wall behind video rack. Jumpers are no less than 12" long.
   2. All cables shall be secured to wall in a neat and workmanlike manor.
   3. All open ports on splitters shall be capped with 75ohm terminator cap. Provide caps as necessary.
   4. All splitters/amplifiers shall be grounded. See drawing for more information.
   5. Provide proper minimum #16 solid grounding cable and termination hardware. See Section 27 05 26 for more grounding information.

6. Provide secondary grounding bus for splitters/amplifiers.
7. Ground secondary bus to main copper ground bus in MDF. Provide proper grounding hardware.

C. For each TV coax jack (F connector) installed in entire facility:
1. Provide a custom made 10 foot black RG6 quad jumper with terminated with F connectors on both ends. Test each cable to rule out any shorts/opens in cable.
a. Box up and give to AV installation vendor.
b. Jumpers will be installed by AV vendor.

3.04 MAIN WORKOUT FLOOR

A. Overhead Soffit TVs:
1. Cat5e: (1 termination per TV)
a. Terminate to female cat5e jack in wallplate.
b. All ceiling wiring must be tied to deck.
2. RF: (1 termination per TV)
a. Design RF System design based on layout on prints.
b. Install RG6/RG11 quad shielded cabling.
c. Terminate with F-Connectors and provide wall plates.
d. Provide RG6 “patch cables” at each wall plate for connection to cardio equipment. Lengths will vary per piece of equipment.
e. All ceiling wiring must be tied to deck.

B. Workout Floor cardio equipment TVs in floor boxes
1. RF: (1 termination per floor box)
a. Design/Provide RF System design based on layout on prints.
b. Install RG6/RG11 quad shielded cabling.
c. Terminate with F-Connectors.
d. Provide RG6 “patch cables” at each floor plate for connection to cardio equipment. Lengths will vary per piece of equipment.

3.05 HEAD-END INSTALLATION

A. Mount head-end equipment in electronic equipment cabinets 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. Head-end components that require tuning adjustments shall be accessible from the front of equipment cabinets.

C. Cable Entrance: Use entrance fittings, seal, and waterproof penetrations of the building envelope.

D. Provide a #6 AWG insulated ground wire from the main equipment rack to the ground bus located in the room.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

B. Identify and tag all cables with permanent type markers to denote location served.
1. Label each coax feed with the zone number associated, location, and calculated line loss. Use professional label, black on white. See section 270553 for labels for communications system.

2. Label input/output of each Splitter with input signal dB and output signal dB.
3. Label input/output of each Amplifier with input signal dB and what output signal dB is set to.
4. Label each tap to correspond with floor box location on Technology Drawing, i.e. C1-01, C1-02 etc.

C. Each major system component shall be labeled as to function and area served.

D. All front panel controls used in the normal operation of the system shall be clearly labeled using plastic laminate engraved labels or approved equal. Labels shall be firmly affixed to the panel or device. Dymo or Kroy tape adhesive backed lettering is not acceptable.

3.07 FIELD QUALITY CONTROL

A. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

B. 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. Off-Air, Mast-Mounted Antenna Sources: Connect receiver to the down lead of a 10-element, single-channel antenna, tuned and oriented to optimize reception for the channel and placed at system antenna's location. Alternatively, connect receiver to a single-channel video amplifier connected to the down lead of the above single-channel antenna.
3. CATV Sources: Connect receiver to an agile demodulator or CATV set-top converter at CATV service entrance to the facility.

C. Final Acceptance Testing Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide notice of test schedule a minimum of 10 days prior to testing.

D. 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.

E. Send test signal and test each TV location, using Digital and Analog RF tester.
1. Test signal from main feed to each drop. See drawing for more information.
   a. If signal is not present at time of balancing, generate a test signal of 28dB to match output of video rack.
2. Adjust amplifiers if attenuation is necessary. Before adjustment, contact/discuss with Life Time AV representative before any changes occur.
3. Measure each jack, at each TV location in entire facility, and ensure it reads between +0dB and +5dBmV. Provide digital RF meter for tests.
4. If adjustment is needed, install correct taps and/or attenuators at each piece to accommodate the proper signal level. Contact/discuss with Life Time AV representative before any changes occur.
5. Provide Microsoft Excel form and/or print out stating measured dB at each TV jack for certification. Turn over documentation to Life Time AV representative upon completion for signoff. Form shall include:
   a. Each Homerun Distance.
   b. Each Homerun dB loss.
   c. Number and final dB reading of each tap, attenuator, and/or splitter in run

d. Measurement of each splitter/amplifier in MDF.

F. Distribution System Acceptance Tests:
1. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 1000 MHz, minimum. Provide documentation of recent calibration agains 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 random sampling of 25 percent of outlets. User-interface outlets.
   a. Test the signal strength in dBmV at 55, 151, 547, and 750 and 1000 MHz.
   b. Minimum acceptable signal level is 0 dBmV (1000 mV).
   c. Maximum acceptable signal level over the entire bandwidth is 15 dBmV.
   d. Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
3. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding head-end amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.

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. Carrier level stability, 60-minute and 24-hour periods.
4. Broadband frequency response.
5. Channel frequency response.
6. Carrier-to-noise ratio.
7. RF visual signal-to-noise ratio.
8. Cross modulation.
9. Carrier-to-echo ratio.
10. Composite triple beat.
11. Second order beat
12. Terminal isolation.
13. Terminal isolation between television and FM.
14. Hum modulation.
15. RF FM carrier level.
16. FM frequency response.
17. FM carrier-to-noise ratio.

H. Record test results.

I. Retest: Correct deficiencies identified by tests and observations and retest until requirements specified in Part 1 are met.

J. After certification:

1. Create “As-Built” drawings of the final RF design, stating length, db loss, etc., of entire facility on a separate set of Technology sheets. Leave a copy Stapled to the wall in the MDF and also send a copy of to the Life Time AV representative upon completion.

END OF SECTION

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SECTION 28 00 00
DIVISION 28 TABLE OF CONTENTS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 08 00 - Commissioning of Safety and Security Systems
28 10 04 - Access Control Devices and Equipment
28 21 00 - Video Surveillance
28 31 11 - Digital Addressable Fire Alarm System
28 31 19 - Distributed Antenna System (Emergency Response)
28 31 20 - Distributed Antenna System (Internal Communication)
28 31 29 - Area of Refuge/Rescue Assistance Systems

END OF SECTION

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SECTION 28 08 00
COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

J. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

K. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

L. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

M. SECTION 33 08 00 - COMMISSIONING OF UTILITIES

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections, but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Identification for Security Systems
   2. Electronic Access Systems
   3. Digital Addressable Fire Alarm System
   4. Distributed Antenna System

END OF SECTION

SECTION 28 10 04
ACCESS CONTROL DEVICES AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Intelligent controllers with licenses.

B. Access control cabinets and power supplies.

C. Card readers.

D. Request-to-exit sensors.

E. Door contacts

F. Key cabinets.

G. Cable terminations.

1.02 RELATED REQUIREMENTS

A. The Drawings, the provisions of the Contract, including General and Supplementary Conditions, and the General Requirements apply to the Work of this Section.

B. Section 08 71 00 Door Hardware.
   1. Review all electric locks, strikes and panic bars.

C. Division 26 – All Sections.

D. Division 27 – All Sections.

E. Division 28 – All Sections.

1.03 DEFINITIONS

A. Access Control Device and Equipment Contractor (ADEC) – The contractor performing the scope of work described in this section.

B. Access Control System Integrator (ACSI) – The owner's current access control system integrator.
   1. Contact:
      Affinitech, Inc
      1264 Park Rd,
      Chanhassen, MN 55317
      +1 (952) 697-2100
      info@affinitechinc.com

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. The ADEC shall meet the following requirements:
   1. Open Options Essentials Certification.
   2. Project Experience
      a. Three (3) years experience in the access control field of commercial, institutional and/or industrial facilities (non-residential).
   3. Minimum Staff Qualifications
      a. Must have the necessary trained, licensed, and bonded trade and technical persons necessary to perform the tasks required under this specification.

b. Licensed as Power Limited Technicians through the Minnesota State Board of Electricity and have successfully completed an accredited, industry related, electronics course.
c. In-house personnel to maintain and submit electronic record documentation in the most current AutoCAD and Microsoft Excel format.

4. References and Qualification Submittal
   a. Project references and qualification submittals shall be provided upon request.

1.05 SUBMITTALS

A. Submit per the General Requirements of the project specifications.

B. Shop Drawings:
   1. Submit to the engineer all data sheets for components. The parts list and the corresponding data sheets shall be submitted in the same order in a single PDF file. Multiple PDF files will be rejected.
   2. A system riser with typical wiring diagram for devices and cabinets

C. Project Coordination Documents:
   1. ADEC Excel Spreadsheet
      a. Provide a Microsoft Excel Spreadsheet listing the controllers with associated boards and devices.
      b. The spreadsheet shall identify:
         1) Install date
         2) Controller numbers
         3) Model
         4) IP address
         5) MAC address
         6) Door numbers
         7) Device termination
         8) Device model number

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage.

B. Provide locked storage units.

C. Contractor shall not deliver, store, or install any product in construction areas where the product is subject to damage from water, dust, and construction debris.

1.07 WARRANTY

A. Provide warranty per the general and supplemental conditions of the contract.

PART 2 PRODUCTS

2.01 SUBSTITIUTIONS

A. Unless noted as “Or Approved Equal” the approved products are standard products in use throughout the owner’s facilities. No substitutions are allowed. If a listed product cannot be provided, notify the engineer in writing prior to the final addendum date and an alternative product will be identified.

B. Where noted as “Or Approved Equal” submit requests per the general terms and conditions of the contract.

C. Approved equals must meet or exceed all manufacturer’s specifications for the listed product. Any exceptions must be approved by the design engineer.

D. Approved equals will only be considered when submitted by a qualified ADEC. Requests from product manufacturers or their representatives will not be considered.

2.02 APPROVED PRODUCTS

A. Intelligent controller module for member management system
   1. Minimum requirements:
      a. Mercury hardware
      b. 96 MB available memory
      c. 2,000,000 card holder capacity
      d. Support 64 total doors with 2 on-board
      e. Open Option license
   2. Approved products:
      a. Open Options LP4502 (SSP-LX)

B. Intelligent controller module for staff management system
   1. Minimum requirements:
      a. Mercury hardware
      b. 6 MB available memory
      c. 240,000 card holder capacity
      d. Support (17) total doors with (1) on-board
      e. Open Option license
   2. Approved products:
      a. Open Options DController (LP1501)

C. 4 door power supply and cabinet for control modules
   1. Minimum requirements:
      a. FPO offline power supply
         1) 120 or 230 VAC input
         2) 12 and 24 VDC outputs
         3) Continuous and resettable DC
      b. Distributed outputs
         1) 8 auxiliary
         2) 4 controlled
         3) PTC option
      c. Lifetime Warranty
   2. Approved products:
      a. Lifesafety Power Supply #LSP-4DR-E4M
      b. Or approved equal.

D. Card reader/keypad
   1. Minimum requirements:
      a. Dimensions: 80 mm x 121.5 mm x 19.5 mm (3.15 in x 4.78 in x 0.77 in)
      b. MHz contactless smart cards supported: Seos®, iCLASS SE, iCLASS®, MIFARE DESFire®EV1/EV2 and MIFARE® Classic.
      c. 125 kHz contactless cards supported: HID Prox®, Indala® Prox, Dorado® Prox, and EM Prox legacy contactless credentials
      d. Protocol: Wiegand
   2. Approved products:
      a. HID 40KNKS-00-000000

E. Request-to-exit sensor

1. Minimum requirements:
    a. Ceiling mount
    b. PIR sensor
2. Approved products:
    a. Bosch DS-160
    b. Or approved equal.

F. Door contact – recessed
1. Minimum requirements:
    a. Recess mount
    b. Match color to frame
    c. DPDT contact arrangement
2. Approved products:
    a. GE Sentrol 1076D
    b. Or approved equal.

G. Key cabinet
1. Minimum requirements:
    a. Manage a minimum of 5 sets of keys
    b. Wall mount
    c. Ethernet (TCP/IP) 10/100MB communications
    d. Reader interface: Clock/ data, Wiegand, Serial (RS232/TTL), Pin only, OSDP Readers (RS485) with or without encryption
    e. Alarm interface: 3x1A/24V dry contact relay contacts
2. Approved products:
    a. Traka Touch Pro V

PART 3 EXECUTION

3.01 PHASING REQUIREMENTS

A. Refer to the architectural phasing plans. Provide all scope of work per the phasing plans.

3.02 INSTALLATION AND OPERATIONAL REQUIREMENTS

A. Access control cabinets
1. Mount the Access Control Cabinets for both the Member Management System and the Staff Management System where shown on plans.
2. Coordinate mounting location of power supplies / cabinets and 120V connection requirements with electrical contractor.
3. ACSI shall identify which doors that are terminated on the Member Management System and the Staff Management System. Coordinate prior to cabling termination in the cabinet.

B. Device cabling
1. Composite device cabling (Belden 658AFJ) is provided by Division 27 15 00 Communications Horizontal Cabling Contractor. Cabling will be installed from the panel location to the ceiling space of the door.
2. Coordinate the location of the device cabling in the ceiling from the cabling contractor and complete routing of the cabling through conduit and frame to device locations.
3. Provide final termination of device cabling to card reader, electric lock, door contact and request-to-exit sensor.
4. Provide final termination of device cabling to the control modules and power supplies. Maintain a 10’ service loop where the cable enters the cabinet.
5. Provide permanent label to each end of the device cable with the device number.

C. Card readers
   1. Coordinate final reader location with electrical contractor prior to electrical rough in.
   2. Provide device cabling to the Access Control Panel identified by the Access Control System Integrator.
   3. Coordinate testing of the card reader operation with the Access Control System Integrator such that the reader is tested at the time of installation.

D. Door contacts
   1. Provide supervised inputs with end of line resistors at the contact. Do not place end of line resistors at the panel location.

E. Request-to-exit sensors
   1. Locate and adjust the sensor to detect person(s) as they contact the exiting door hardware.
   2. Adjust as required to minimize false alarms.
   3. Adjust timers per recommendations from the Access Control System manufacturer.

F. Electric lock
   1. Electric lock provided by Division 08 71 00 Door Hardware Contractor.
   2. Coordinate connection requirements and lock voltage with Hardware Contractor.
   3. Provide cable routing through frame, hinge/transfer, and final cable termination.

G. Key cabinets
   1. Mount the key cabinets where shown on plans.
   2. Coordinate mounting location of power supplies / cabinets and 120V connection requirements with electrical contractor.
   3. Coordinate the network jack, patch panel, and TR room number for the key cabinet with the Division 27 15 00 Communications Horizontal Cabling Contractor.

H. Labeling
   1. All labels shall be machine printed white background black letter labels with permanent ink and permanent adhesive.
   2. Handwritten labels are not acceptable at any locations.
   3. All equipment, cabinets, and junction boxes shall be labeled to match the designators shown on a corresponding as-built riser wiring diagram.
   4. Each cable shall be labeled at all terminations points to match a corresponding as-built wiring diagram. Labeling is not required for interconnections within an enclosure or assembly.
   5. Submit a labeling plan to the owner prior to label installation.

3.03 CLOSEOUT ACTIVITIES

A. Provide testing and close out per each phase as shown in the architectural phasing plan.

B. System testing
   1. Testing shall be a coordinated effort between the ACSI, and the ADCE. Each contractor shall provide technicians to fully test each door.
      a. ADCE – Provide a technician at the door.
      b. ACSI– Provide a technician at the head end and provide either a laptop or connection to a workstation to facilitate testing.

C. Each door shall be tested in sequential order and a corresponding written test report shall be submitted to the engineer. Test each door and each of the following conditions in this order:
   1. System Testing - Test each door and each of the following conditions in this order:
      a. Normal card read – No alarms.

b. Normal egress – No alarms, adjust RTE sensors to eliminate false alarms.
c. Prop door – workstation alarm.
d. Forced door – workstation alarm.

D. Conduct a final acceptance test with the Owner and ACSI after system testing is complete, test reports have been submitted, and as built documentation has been submitted.
1. Upon completion of the above items and all requirements identified in the plans and specifications:
a. Notify the engineer in writing and request final acceptance.
b. Conduct an on-site demonstration to the engineer of system performance and compliance with the plans and specifications.
c. Correct any items noted by the engineer during acceptance and submit a signed punch list of corrections made..

E. Submit project closeout documentation.
1. Final ADEC Excel Spreadsheet
2. As-built plans in AutoCAD format.
a. As-builts shall include floorplans showing symbols for all devices, access control panel locations, and power supply locations.
b. Riser diagrams showing interconnection of all devices and controller locations.
c. Elevations of access control cabinets and powers supplies.
3. Operator and Maintenance Manuals shall be submitted as electronic documents or media. Hardcopy shall only be submitted if electronic versions are not available.

F. Issue a statement of warranty to the Owner and copy the Engineer.

END OF SECTION

SECTION 28 21 00
VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior directional cameras.

B. Interior panoramic cameras.

C. Indoor environmental rated camera.

D. Exterior directional camera.

E. Patch cables.

F. Corporate camera licenses.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 34 - Conduit for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Division 27 - All sections.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 303 - Standard for Installing Closed-Circuit Television (CCTV) Systems; National Electrical Contractors Association; 2005.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 DEFINITIONS

A. Video Surveillance Camera Contractor (VSCC) – The contractor performing the scope of work described in this section.

B. Video Management System Integrator (VMSI) – The owner’s current video system integrator.

1. Contact:

Affinitech, Inc
1264 Park Rd,
Chanhassen, MN 55317
+1 (952) 697-2100
info@affinitechinc.com

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings
   1. Submit to the engineer all data sheets for components. The parts list and the corresponding data sheets shall be submitted in the same order in a single PDF file. Multiple PDF files will be rejected.

C. Project Coordination Documents
   1. VSCC Excel Spreadsheet
      a. Provide a Microsoft Excel Spreadsheet listing the cameras in sequential order as shown on floorplans.
      b. The VSCC spreadsheet shall identify:
         1) Install Date
         2) Device Number
         3) Floor
         4) Model
         5) Mount
         6) Firmware
         7) Serial Number
         8) MAC Address
         9) Patch Panel Termination
         10) IP Address

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with the following:
   1. NFPA 70
   2. Applicable TIA/EIA standards.

C. The VSCC shall meet the following requirements:
   1. Axis certified professional.
   2. Project experience:
      a. Five (5) years experience in installation of IP camera systems.
      b. Five (5) projects exceeding (50) cameras within the last (5) years.
   3. Minimium staff qualifications:
      a. Must have the necessary trained, licensed, and bonded trade and technical persons necessary to perform the tasks required under this specification.
      b. Licensed as Power Limited Technicians through the Minnesota State Board of Electricity and have successfully completed an accredited, industry related, electronics course.
      c. Two (2) persons assigned to the project that have completed the Axis Certification Program and are directly responsible for:
         1) Camera configuration.
         2) On-site camera installation.
         3) As-built documentation.

d. In-house personnel to maintain and submit electronic record documentation in the most current AutoCAD and Microsoft Excel format.

4. References and qualification submittal.
   a. Project references and qualification submittals shall be provided upon request.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

C. Provide locked storage units.

D. Contractor shall not install any product in construction areas where the product is subject to damage from water, dust, and construction debris.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. Provide warranty per the general and supplemental conditions of the project.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted as “Or Approved Equal” the approved products are standard products in use throughout the owner’s facilities. No substitutions are allowed. If a listed product cannot be provided, notify the engineer in writing prior to the final addendum date and an alternative product will be identified.

B. Where noted as “Or Approved Equal” submit requests per the general terms and conditions of the contract.

C. Approved equals must meet or exceed all manufacturer’s specifications for the listed product. Any exceptions must be approved by the design engineer.

D. Approved equals will only be considered when submitted by a qualified VSCC. Requests from product manufacturers or their representatives will not be considered.

2.02 APPROVED PRODUCT

A. Interior directional camera
   1. Minimum Requirements
      a. Overview
         1) Resolution: 2MP.
         2) Zipstream.
         3) Lens: Varifocal, 3.4–8.9 mm, F1.8.
         4) WDR: Forensic Capture.
         5) Axis’ Lightfinder technology.
      b. Video Compression
         1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main, and High Profiles H.265 (MPEG-H Part 2/HEVC) Main Profile Motion JPEG.
      c. Video Streaming

1) Multiple, individually configurable streams in H.264, H.265, and Motion JPEG Axis Zipstream technology in H.264 and H.265 controllable frame rate and bandwidth VBR/ABR/MBR H.264/H.265 low latency mode video streaming indicator.

d. Power
1) Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 2 Typical 3 W, max 5.1 W.

e. Mount
1) Provide mounts as shown on plan, schedule, and/or required for proper installation of a complete system.

2. Approved products:
a. Camera type Axis P3265-V.

B. Interior panoramic camera
1. Minimum Requirements:
a. Overview
1) Resolution: 6MP.
2) Zipstream.
3) Lens: 1.6 mm, F2.0.
4) WDR: Forensic Capture.
5) Axis' Lightfinder technology.

b. Video Compression
1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main, and High Profiles H.265 (MPEG-H Part 2/HEVC) Main Profile Motion JPEG.

c. Video Streaming
1) Multiple, individually configurable streams in H.264, H.265, and Motion JPEG Axis Zipstream technology in H.264 and H.265 Controllable frame rate and bandwidth VBR/ABR/MBR H.264/H.265 Low latency mode Video streaming indicator.

d. Power
1) Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 2 Typical 3.7 W, max 6.49 W.

e. Mount
1) Provide mounts as shown on plan, schedule, and/or required for proper installation of a complete system.

2. Approved products:
a. Camera type Axis M3067-P.

C. Indoor environmental rated camera
1. Minimum Requirements:
a. Overview
1) Resolution: 2MP.
2) Zipstream.
3) Lens: Varifocal, 3.4–8.9 mm, F1.8
4) WDR: Forensic Capture.
5) Axis' Lightfinder technology.

b. Video Compression
1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main, and High Profiles H.265 (MPEG-H Part 2/HEVC) Main Profile Motion JPEG.

c. Video Streaming

1) Multiple, individually configurable streams in H.264, H.265, and Motion JPEG Axis Zipstream technology in H.264 and H.265 Controllable frame rate and bandwidth VBR/ABR/MBR H.264/H.265 Low latency mode Video streaming indicator.

d. Power
1) Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 2 Typical 4.8 W, max 10.7 W.

e. Mount
1) Provide mounts as shown on plan, schedule, and/or required for proper installation of a complete system.

2. Approved products:
a. Camera type Axis P3265-LVE.

D. Exterior directional camera
1. Minimum Requirements:
a. Overview
1) Resolution: 8MP.
2) Zipstream.
3) Lens: Varifocal, 6.2–12.9 mm, F1.6–2.9.
4) WDR: Forensic Capture.
5) Axis' Lightfinder technology.

b. Video Compression
1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main, and High Profiles H.265 (MPEG-H Part 2/HEVC) Main Profile Motion JPEG.

c. Video Streaming
1) Multiple, individually configurable streams in H.264, H.265, and Motion JPEG Axis Zipstream technology in H.264 and H.265 Controllable frame rate and bandwidth VBR/ABR/MBR H.264/H.265 Low latency mode Video streaming indicator.

d. Power
1) Power over Ethernet (PoE) IEEE 802.3at Type 2 Class 4 Typical 9 W, max 23 W 10–28 V DC, typical 9 W, max 24 W.

e. Mount
1) Provide mounts as shown on plan, schedule, and/or required for proper installation of a complete system.

f. Powder coating
1) Provide powder coating of camera body. Color code furnished by architect.

2. Approved products:
a. Camera type Axis Q3538-LVE with custom powder coating.

E. Patch cables
1. Minimum requirements:
a. Provide patch cabling from device jack to camera.
b. Provide patch cabling from the patch panel to network switch.
c. 7' length typical, unless noted otherwise.
d. Stranded cabling.
e. Booted.
f. Plenum rated.
g. Meet or exceed Cat6 TIA/EI-568-B2.1.
h. Blue jacket.

2. Approved products:

a. Systimax.
b. Panduit.
c. Leviton.
d. Or approved equals.

F. Corporate camera licenses
1. Approved products:
a. Milestone XProtect corporate license.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PHASING

A. Phasing and scheduling.
1. Complete all work in accordance with the architectural project phasing plans and specifications.

3.03 INSTALLATION AND OPERATIONAL REQUIREMENTS

A. Material and workmanship shall comply with applicable codes. As a minimum, codes include all state and federal laws, local ordinances and interpretations of the following by the local Authority Having Jurisdiction (AHJ).

B. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

C. Comply with all OSHA requirements.

D. Camera configuration and pretest
1. Prior to installation, connect the camera to a test PC and POE network switch (contractor owned).
a. Upgrade the camera firmware to the most recent available firmware approved by the VMSI.
b. Configure the default password as directed by the VMSI.
c. Configure the default IP Address as directed by the VMSI.
d. Test the following applicable functions:
1) Motorized or manual focus.
2) IR illumination.
3) Inspect the image for clarity and color reproduction.
4) Inspect the camera door for scratches or other visual deficiencies.
5) Inspect the camera housing for scratches, cracks, or other deficiencies.
2. Receive the network jack, patch panel, and TR room number for each camera from the Division 27 15 00 Communications Horizontal Cabling Contractor.
3. Provide a permanent label to the rear of the camera body denoting the camera number.
a. Black lettering on clear backing, 0.125” W.

4. Log all resulting configuration information in the VSCC spreadsheet and submit to the VMSI for approval prior to camera installation.

E. Camera installation
   1. Follow instructions in the installation documentation provided by the camera manufacturer.
   2. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.
   3. Refer to camera details and schedules for mounting and accessory requirements.
   4. Seal exterior camera raceways and penetrations to prevent water infiltration to the building and camera enclosure.
   5. Field of View coordination.
      a. Prior to the installation of any cameras, the contractor shall review each location and view with the VMSI.
      b. Locate the camera to best provide the intended field of view. Where placement adjustments are required, locate the camera to provide a larger area of view than shown on plans. Notify the VMSI of any issues prior to installation.
      c. Do not install cameras in any location where the field of view is blocked by signage or any other visual obstruction. It is the contractor's responsibility to notify the owner of any locations that should be changed to provide the intended field of view.
   6. Once installed, provide a final cleaning of the camera assembly. Ensure that domes or viewing window are free of dirt, dust, and fingerprints.
   7. Focus the camera per manufacture instructions.
   8. Turn on WDR for any cameras where light differentials may cause silhouetting of the foreground image. Typical locations include:
      a. Perimeter vestibules and perimeter doors.
      b. Loading dock doors.
      c. Skyways.
      d. Window lined corridors.
      e. Rooms with exterior windows.
   9. Test images.
      a. Capture a test image of each camera in full resolution. Name the image filename to match the camera number.
      b. Submit a test image of each camera view to the VMSI.

F. Raceway and patch cabling from the camera to the data jack.
   1. Coordinate final camera locations with the Division 27 15 00 Communications Horizontal Cabling Contractor.
   2. Provide patch cabling from the camera to the camera data jack.
   3. Exposed patch cabling from the camera to the data jack is allowed in accessible ceiling spaces.
   4. In interior exposed areas and exposed ceiling spaces, provide metallic wiremold or surface conduit from the camera to the data jack or accessible ceiling space.
   5. For exterior cameras, provide flexible metallic sealtight conduit from the camera to the data jack or accessible ceiling.

G. Provide required support and attachment for each installed condition.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Install firestopping to preserve fire resistance rating of partitions and other elements.

J. Identify system wiring and components.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Acceptance Testing.
   1. Schedule an acceptance test with the owner and VMSI after all record documentation is submitted for approval.
      a. Provide on site demonstration of installed equipment.
      b. Demonstrate device locations and cabling terminations.
   2. A punch list of deficiencies will be generated by the engineer.
   3. Make all required corrections and return a signed punch list stating that all repairs are complete.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Location: At project site.

C. Submit: Project closeout documentation.
   1. Final VSCC Microsoft Excel spreadsheet.
   2. Final image file from each camera.
   3. As-built floorplans in AutoCAD format showing:
      a. Camera locations.
   4. Warranty letter.
   5. All close out documentation required by the general and supplemental conditions of the contract.

D. Warranty
   1. Provide a 1-year parts and labor warranty. The warranty period shall commence with the completion of all punch list items.
   2. Material Warrantees – Identify the material warranty period for all devices.
   3. Submit all warranty information in a warranty letter to the owner. The warranty letter shall be signed by a company officer.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION

SECTION 28 31 11
DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Maintenance of fire alarm system under contract for specified warranty period.

1.02 REFERENCE STANDARDS

A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 72 - National Fire Alarm Code and Signaling Code ; 2010.

1.03 SUBMITTALS

A. See Division 1 sections for submittal procedures.

B. Engineer will provide electronic floor plan drawings for Contractor's use upon request; verify all dimensions on provided drawings.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
   12. Certification by Contractor that the system design complies with the contract documents.

D. Evidence of installer qualifications.

E. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.

3. Submit NFPA 72 "Inspection and Test Form," filled out.

F. Operating and Maintenance Data: See Division 1 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

G. Project Record Documents: See Division 1 for additional requirements; have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

H. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
   3. Certificate of Occupancy.

1.04 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Certified in the State in which the Project is located as fire alarm installer.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.05 WARRANTY

A. See Division 1 Section Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units - Subject to compliance with requirements, provide products by the following:
   1. Silent Knight, by Honeywell.
   2. Fire Lite Alarms, by Honeywell.

B. Initiating Devices, and Notification Appliances:
   1. Same manufacturer as control units.
   2. Provide all initiating devices and notification appliances made by the same manufacturer.

C. Substitutions: As required by Authority Having Jurisdiction after review by owner, contact: Fire and Safety Systems Project Manager, 952-229-7273.

2.02 SEQUENCE OF OPERATIONS

A. Basic Alarm Performance Requirements: Unless otherwise indicated on the drawings, operation of a manual station, automatic alarm operation of a smoke or heat detector, or operation of a sprinkler flow device initiates the following:
   1. Indication of alarm condition at the FACP and the annunciator(s).
   2. Identification of the device or zone that is the source of the alarm at the FACP and the annunciator(s).
   3. Operation of audible and visible notification devices throughout the building until silenced at FACP.
   4. Unlocking designated doors.
   5. Shutting down supply and return fans that have duct smoke detectors.
   6. Closing smoke dampers on system serving zone where alarm is initiated.
   7. Notifying the local fire department.
   8. Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.
   9. Shut down of audio reinforcement systems throughout building as indicated on the drawings.

B. Supervisory Operations: Upon activation of a supervisory device such as a tamper switch or carbon monoxide detector, the system shall operate as follows:
   1. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
   2. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
   3. Record the event in the FACP historical log.
   4. Transmission of supervisory signal to remote central station.

5. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

C. Fire Suppression Monitoring:
   1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
   2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
   3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

D. Required Functions: The following are required system functions and operating features:
   1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
   2. Non-interfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
   3. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
   4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.
   5. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible (and visible alarm signals shall cease operation.
   6. System Reset
      a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
      b. Should an alarm condition continue, the system will remain in an alarmed state.
   7. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
   8. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
      a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
      b. Control relay functions associated to one of the 8 testing groups shall be bypassed.
      c. The control unit shall indicate a trouble condition.
      d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
      e. The unit shall automatically reset itself after signaling is complete.

f. Any opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

2.03 FIRE ALARM SYSTEM

A. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

E. Remote Access:
1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
3. FACP shall have the capability to provide third party access through a serial interface connection and be agency listed for specific interfaces and for the purpose.
4. FACP shall have the capability to provide remote access via an Internet/Intranet Interface. The Internet interface shall provide an alternative access to system information using the familiar interface of a standard Internet browser. A remotely located fire professional can use this access to analyze control panel status during non-alarm conditions and can also use this information to assist local fire responders during alarm conditions.

F. Voice Alarm Notification: By speakers in areas as indicated on drawings.

G. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. Remote Supervising Station: UL-listed central station under contract to facility.
3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

H. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

I. Spare Capacity:

1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
   3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down roof top unit and corresponding zone.
   2. Carbon Monoxide Detectors: Shut down roof top unit and corresponding zone.

E. Sound Reinforcement Systems: Shut down via relay as indicated on the drawings. Reset automatically upon alarm clear.

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. System Wiring: Wiring shall be as indicated on the drawings. Wire shall be in conduit inside walls and inaccessible ceilings, and where required by local code. Plenum rated power limited cable may be used where allowed by local code. Plenum rated cables shall be red in color. Individual conductor colors in conduit shall not correspond to other colors used for power wiring in building. Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
   1. Wire shall be power-limited fire alarm cable. Type FPLP#14 AWG solid conductor cable, unshielded.
      a. West Penn Wire #60993B(2-conductor); #60700B (4-conductor).
      b. Belden
      c. Superior
      d. Allied Wire

e. Honeywell
f. Engineer Approved Equal.

C. Fire Alarm Control Panel (FACP)
1. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
2. The following FACP hardware shall be provided:
a. Power Limited base panel with red cabinet and door, 120 VAC input power.
b. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
c. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node.
d. 2000 points of annunciation where one (1) point of annunciation equals:
1) One (1) LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
2) One (1) LED on panel or 1 switch on panel.
e. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
f. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
g. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
h. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
i. Three (3) Class B or A (Style Y/Z) Notification Appliance Circuits (NAC; rated 3A@24VDC, resistive).
j. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
k. The FACP shall support (6) RS-232-C ports and one service port.
l. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
m. Programmable DACT for either Common Event Reporting or per Point Reporting.
n. Service Port Modem for dial in passcode access to all fire control panel information.
3. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
4. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

D. Auto-call System Interface
1. When a fire alarm system using existing Auto-call XA loop devices requires expansion FACP shall be capable of interfacing to the XA loop via an interface module. This module shall allow the FACP to be selected to function as either the XA loop master controller (head end) or as a Data Gathering Panel as an intelligent device on the XA loop reporting to a remote master controller. Multiple XA Loop Interface Modules can be installed in the FACP allowing a variety of system expansion situations to be satisfied.

E. Remote LCD Annunciator

1. Provide where required a remote LCD Annunciator with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.
2. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
3. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
4. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
5. The LCD shall display the following information relative to the abnormal condition of a point in the system:
   a. 40 character custom location label.
   b. Type of device (e.g., smoke, pull station, waterflow).
   c. Point status (e.g., alarm, trouble).
6. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

F. Emergency Power Supply
   1. General: Components include battery, charger, and an automatic transfer switch.
   2. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.

G. Addressable Manual Pull Stations
   1. Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
   2. Protective Shield:
      a. At wall mounted locations: Where indicated on drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations.
      b. At casework mounted locations: Where indicated on drawings, provide a tamperproof, low profile, clear LEXAN shield and red frame that easily fits over manual pull stations. The shield shall protrude a maximum of 2 inches and shall not interfere with operation of casework. Coordinate with casework provider.
      c. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
      d. Protective shields shall be provided at all pull stations within childcare area.

H. Smoke Sensors
   1. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
      a. Factory Nameplate: Serial number and type identification.
      b. Operating Voltage: 24 VDC, nominal.

c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
d. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
e. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
f. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
g. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
h. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
i. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
j. Removal of the sensor head for cleaning shall not require the setting of addresses.

2. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.
3. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
4. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
   a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
   b. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
   c. Duct Housing shall provide a relay control trouble indicator Yellow LED.
   d. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
   e. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
   f. Duct Housing shall provide a magnetic test area and Red sensor status LED.
   g. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

h. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
i. Where indicated provide a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

I. Heat Sensors
1. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
2. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
3. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
4. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

J. Carbon Monoxide Sensors
1. General: Carbon monoxide detector listed for connection to fire alarm system.
a. Mounting: Adapter plate for outlet box mounting.
b. Testable by introducing test carbon monoxide into the sensing cell.
c. Detector shall provide alarm contacts and trouble contacts.
d. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
e. Comply with UL 2075.
f. Locate, mount, and wire per manufacturer's written instructions.
g. Provide means for addressable connection to fire alarm system.
h. Test button simulates an alarm condition.

K. Addressable Circuit Interface Modules
1. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
2. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
3. There shall be the following types of modules:
a. Type 1: Monitor Circuit Interface Module:
1) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
2) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
b. Type 2: Line Powered Monitor Circuit Interface Module

1) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
2) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.

c. Type 3: Single Address Multi-Point Interface Modules
1) This multi-point module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
2) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
3) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

d. Type 4: Line Powered Control Circuit Interface Module
1) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

e. Type 5: 4-20 mA Analog Monitor Circuit Interface Module
1) This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

4. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

L. Addressable Alarm Notification Appliances
1. Addressable Notification Appliances: The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).

a. Addressable Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
b. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
c. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.

2. Addressable Controller: Addressable Controller shall supervise Channel (SLC) wiring, communicate with and control addressable notification appliances. It shall be possible to program the High/Lo setting of the audible (horn) appliances by channel from the addressable controller.
3. Horn: Addressable horn shall be listed to UL 464. Horn appliances shall have a High/Lo Setting, programmable by channel from the addressable controller or by appliance from the host FACP. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.
4. Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
5. Audible/Visible: Addressable combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliance shall be capable of two-wire synchronization with one of the following options:
   a. Synchronized Strobe with Horn on steady
   b. Synchronized Strobe with Temporal Code Pattern on Horn
   c. Synchronized Strobe with March Time cadence on Horn
   d. Synchronized Strobe firing to NAC sync signal with Horn silenced
6. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker operates on a 25VRMS or 70.7VRMS NAC.

a. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
b. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
c. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
d. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension.

7. Isolator Module: Isolator module provides short circuit isolation for addressable notification appliance SLC wiring. Isolator shall be listed to UL 864. The Isolator shall mount directly to a minimum 2 1/8" deep, standard 4" square electrical box, without the use of special adapter or trim rings. Power and communications shall be supplied by the Addressable Controller channel SLC; dual port design shall accept communications and power from either port and shall automatically isolate one port from the other when a short circuit occurs. The following functionality shall be included in the Isolator module:
   a. Report faults to the host FACP.
   b. On-board Yellow LED provides module status.
   c. After the wiring fault is repaired, the Isolator modules shall test the lines and automatically restore the connection.
8. Accessories: The contractor shall furnish the necessary accessories.

M. NAC Power Extender
1. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
2. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
3. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNET Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.
4. For IDNet connected NAC extender panels up to five panels can be connected on a single IDNet channel.
5. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.
6. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

N. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

O. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

P. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
   1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
   2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
   3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

Q. Locks and Keys: Deliver keys to Owner.
   1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type.

R. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. All wiring on second floor exercise area shall be concealed in gypsum board soffits. Where visible routing is required, wiring shall be straight, level, and plumb, and secured at 36 inch intervals to avoid sagging. Low voltage cable straps must be used.

D. Obtain Engineer's approval before modifying any locations of devices indicated on drawings.

E. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

C. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. All aspects of operation have been demonstrated to Owner.
   4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   5. Occupancy permit has been granted.
   6. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

A. See Division 1 specification Execution Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

3.06 MONITORING

A. Fire Alarm Monitoring services shall be contracted by Owner with Life Safety Fire & Security Solutions.
1. Contact Owner prior to engaging Life Safety Fire & Security Solutions.
2. Contact, Life Safety Fire & Security Solutions, Tempe AZ: Leo Gonzales, 716-382-7965.

END OF SECTION

SECTION 28 31 19
DISTRIBUTED ANTENNA SYSTEM (EMERGENCY RESPONSE)

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 performance requirements and products for a bi-directional amplifier system. A bi-directional radio frequency (RF) amplifier will be required inside the building. Antennas will be installed where indicated in the building to transmit and receive the radio signals. The system shall ensure full building coverage for the two way communications for the emergency services in the area. An outdoor donor antenna will be mounted on the roof as indicated. All required cabling shall be provided for a complete and functional system. The Contractor shall provide a fully functional Distributed Antenna System compliant with local first responder emergency services requirements and the following specifications.

1.03 IN-BUILDING DAS SPECIFICATION

A. Description: For purposes of this specification, a distributed antenna system is an in-building wireless system facilitating frequencies as required by the authority having jurisdiction, designed to serve emergency response services. The system antenna design and layout shall be engineered and configured to meet local Fire Department coverage requirements. Calculations shall be provided for each supported service, to verify the signal levels required to maintain the specified reliability and coverage objectives.

B. The system shall meet all requirements for the local fire department. All tests and documentation shall be completed per local codes.

C. The in-building Distributed Antenna System (DAS) solution must be implemented with proven, type-accepted, state of the art technology.

D. The DAS system proposed by the Contractor must comply with the following design, coverage and reliability requirements:
   1. Active Signal Handling
      a. The in-building DAS shall have active powered elements that filter and amplify signals on a band specific basis to consistently deliver wireless services at the appropriate power levels.
   2. Signal Distribution
      a. The in-building DAS shall utilize a coaxial distribution cable with passive, broadband antennas in the distribution area.
   3. Life Safety Centralized Power
      a. The in-building DAS system shall be powered through a local UPS. The UPS shall provide full operation of the system for a minimum of 12 hours at rated output in the event of a power failure. See below for UPS specification.
   4. Delivered Audio Quality (DAQ) level shall be 3.4 or above. DAQ 3.4 is defined as "speech understandable without repetition. Some noise/distortion present."

E. Acceptance Testing Procedure

1. Upon completion of installation, The Contractor shall have the radio system tested to ensure that two-way communications coverage in the building and on each floor meets the specified performance requirements. Each floor of the building shall be divided into a grid of 20 equal squares or a grid spacing of no more than 50 feet by 50 feet. Testing criterial shall be in accordance with local code requirements. Signal level measurements shall be made using a test receiver with sensitivity and thermal noise floor equal to or better than the Department of Safety radio, taking at least one sample measurement of the radio system control channel within each accessible grid location.
2. Ensure all documentation is ready for final inspection.
    a. Document all plots for transmission lines. Show that the TDR instrument is calibrated to NIST specifications.
    b. Provide a chart showing loss for each transmission line.
    c. Provide all engineering calculations in plan set.
        1) Link budget from interior antennas as well as link budget for the donor antenna to the public safety repeater site. Include both downlink and uplink calculations.
    d. Document downlink field strengths on the gridded off floor plan set.
    e. Document and show downlink and uplink noise floor as measured with a spectrum analyzer.
    f. Document and show spectrum plot of the downlink signal as present from the donor antenna.
    g. Capture all BDA configuration pages and provide a copy in documentation.
    h. Show on the air downlink plot from the spectrum analyzer as measured at the output of the BDA.
3. If the building fails to achieve the coverage requirement, the Contractor shall provide additional DAS equipment as required and conduct a new acceptance test.
4. Contactor shall pay all fees associated with testing the system.

1.04 RANGE OF SERVICE

A. Public Safety Spectrum
1. The in-building DAS head end equipment shall be capable of supporting the spectrum, services, applications, and technologies required by the local fire department.
2. System Overview
    a. The radios DAS head end equipment will be located as indicated in the Contract Documents.
    b. IEEE 802.11 a/b/g/n will not be part of the DAS design.
3. The primary role of the DAS system is to provide life safety radio communications. As such, reliability should be a primary goal of the design.
4. Recommended Coverage Design Goal
    a. The radio system control channel signal level shall exceed -95dBm at 95% or more of the locations measured within each grid area. Equivalently, the service area reliability shall be 95% or greater on each floor of the structure.
5. Failure Detection
    a. DAS equipment shall have failure detection circuitry which provides detection of mechanical, electrical, and power failure of the DAS, as well as oscillation detection capability which will reduce the amplifier output to zero in the event of a system oscillation. Detection of any failure shall result in a distinct audible notification at a constantly attended location approved by the Fire Department.

1.05 SUBMITTALS

A. Product Data:

1. Product Data for all items provided under this Section.
    a. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
    b. Indicate how the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
    c. Highlight with yellow or blue marker, or indicate with arrow stamp, adequate information to demonstrate materials being submitted fully comply with contract documents.
    d. Indicate listing by UL or other approved testing agency.
    e. Manufacturers' Cable Installation Instructions

B. System Block Diagram: Provide a block diagram illustrating system components and connectivity requirements. At a minimum label: cabling requirements, electrical requirements, and related system components. Include detailed diagrams of head end and rooftop equipment.

C. Operation and Maintenance Data: For system components to include in emergency, operation, and maintenance manuals.

D. Shop Drawings
1. Provide detailed plan views (minimum scale 3/32"=1'-0") and elevations of all telecommunications spaces showing field conditions, ancillary room components, dimensions, equipment racks, termination blocks, patch panels, cable paths and workspace requirements for access to equipment and cable connections.
2. Ratings of items.
3. Fire rating of room penetrations.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
5. Provide plan drawings of each floor of each building showing:
    a. Routing for all cables installed under this Work.
6. Reports and Schedules
    a. Provide Cable Termination Schedules for all cables installed under this work, with the following information:
        1) Backbone cables
        2) Horizontal (antenna) distribution cables
7. Provide sample reports showing the proposed format for cable test reports.

E. As Built Drawings: The Contractor shall provide a complete set of as-built drawings.

F. Permits: Contractor shall obtain and submit required permitting for the installation of the system. Contractor shall provide all required submittals to the local authority having jurisdiction and the Fire Department. Contractor shall fill out and provide design and engineering specifications per local requirements to obtain permit.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. The installation shall be performed by a company that has been in the business of installing DAS systems for a period of at least three years.

C. Response times for remote diagnostics shall be within two hours, on site diagnostics within 8 hours, and parts availability / service restoration within 24 hours.

D. References: Provide manufacturer references for five projects of a similar size / scope where the system proposed is currently installed. Provide contact information at each site as well as any written recommendations available.

E. 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.

F. Comply with NFPA 70 for components and installation.

G. Comply with local Fire Code.

1.07 WARRANTY

A. Provide a warranty of 2 years from substantial completion.

PART 2 PRODUCTS

2.01 EQUIPMENT MANUFACTURERS

A. All equipment shall be the product of a manufacturer that has been in the business of manufacturing like product and financially stable for a period of at least five years. The Contractor shall provide equipment references as required in the request for proposals for any substitutions.

B. The Contractor shall commit, in writing, to factory support for the primary components of the DAS system, providing hardware availability and support for a minimum period of ten years following system implementation. The primary components shall include all equipment by a single or multiple manufacturers, totaling at least 70% of the capital equipment cost.

2.02 PARTS AND EQUIPMENT SPECIFICATIONS

A. Contractor shall provide parts and equipment list, and specifications for all components of the system, including:
   1. Shielded Coaxial Cable and connectors.
   2. Coaxial splitters and terminators.
   3. Interior Antennas.
   4. Donor antennas.
   5. Radios, amplifiers, head end equipment.

2.03 BI-DIRECTIONAL AMPLIFIER (BDA)

A. Maximum output power: As required to provide coverage for entire building.

B. Minimum gain: 80 dB.

C. Frequency band uplink/downlink: as required by authority having jurisdiction.

D. Technology:
   1. Digital repeater with channel filtering.
   2. Signal to be repeated is FM, system must be capable of P25 digital.

E. Input and output impedance: 50 ohms.

F. Enclosure: NEMA 4

G. Additional outputs: System shall have alarm output.

H. BDA shall included re-tunable or replaceable filters to acommodate pass band changes. The use of non-adjustable and non-replaceable RF duplexer filters is prohibited.

2.04 ANTENNAS

A. Exterior Donor Antenna: Yagi 12 dBd gain.

B. Interior Omni-directional antenna: 1.5 dBi gain.

C. Interior directional panel antenna: 6 dBd gain.

2.05 DIRECTIONAL COUPLERS & SPLITTERS

A. Directional Couplers

B. Power Splitter

2.06 WIRING AND CABLES

A. Coax: ½" coax transmission line.
   1. Jack material: PE.
   2. Outer conductor material: Corrugated copper.
   3. Dielectric material: Foam PE.
   4. Inner conductor material: Copper-clad aluminum wire.
   5. Jacket color: Black.
   6. Cable shall be plenum rated.
   7. Andrews LDF4-50A.

B. Jumper Cables:
   1. Jumper cables shall be RJ-142 jumpers cables with type "N" male connectors on each end.

2.07 LIGHTNING PROTECTION DEVICE

A. Provide lightning protection equipment on cabling entering the building from the exterior donor antenna. Ground antenna to building grounding system.

2.08 UNINTERRUPTIBLE POWER SYSTEM

A. Rack-Mounted Uninterruptible Power Supply (UPS) shall be furnished and installed for the radio repeater system with the following requirements:
   1. 19" rack/cabinet mountable and two rack units in height. Provide necessary mounting hardware.
   2. Rated for 12-hours of backup capacity.
   3. Six NEMA 5-15R receptacles and 10' line cord with NEMA 5-15P plug.
   4. Approved manufacturer: American Power Conversion.
   5. Approved equals by Tripp Lite and Liebert.

2.09 SPARE MATERIALS

A. Furnish spare 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 not less than one of each item listed below. Deliver extra materials to Owner.
   1. Antennas: One of each type installed.
   2. Passive Components (taps, combiners, splitters, couplers, etc.): One of each type installed.
   3. Cable: 100 feet (30 m); each type used
   4. Jumper Cables: Two for every type installed.

PART 3 EXECUTION

3.01 INSTALLATION

A. The installation shall be performed by a company that has been in the business of installing DAS systems for a period of at least three years.

3.02 COORDINATION

A. Design coordination is required for this Work. Coordination with General Contractor and the design team is required to address system integration and structure cabling design.

B. Coordinate Work of this Section with on-site General Contractor and their sub-contractors.

C. Coordinate layout and installation of distributed antenna system equipment and antenna cable with other construction that penetrates ceilings or is supported by them, including but not limited to light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

D. Coordinate locations of any equipment that differs from that shown on the Construction Documents with the Engineer and Owner prior to installation. All difference shall be clearly noted in the submittals. Special consideration shall be taken to install antennas in areas with the least visual impact. All cabling shall be concealed wherever possible and adequately supported.

E. Coordinate installation and system level measurement with engineer, Owner, vendors and installation contractors.

F. Coordinate with the local public safety jurisdiction and secure "Approval to Carry" letter from the owner of each public safety radio system carried by the DAS.

3.03 CABLE INSTALLATION

A. Coaxial cable, and other associated cable and wiring shall be installed in sleeves indicated on the Construction Documents for antenna system. Provide proper support for all cabling. Cabling shall be installed in a neat and workmanlike manor. Any cabling deemed by the Engineer to be improperly installed or improperly supported shall be fixed by the Contractor at no expense to the Owner. Provide j-hooks where cable trays are not present, and install cabling in conduit where installed in exposed finished areas.

B. Coaxial cables are to be terminated at bulkheads in each designated equipment room. Provide proper grounding on each bulkhead.

C. Contractor will provide as-built documentation of the installed cable system.

3.04 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

B. All installed cable shall be labeled "INTERNAL DISTRIBUTED ANTENNA SYSTEM CABLE" every twenty feet.

C. Provide an information sign labeled “THIS BUILDING IS EQUIPPED WITH A RADIO REPEATER SYSTEM” conspicuously posted above fire control panel.

3.05 FIELD QUALITY CONTROL

A. Contractor shall provide detailed documentation specifying test procedures for installed cabling, antennas, radios, amplifiers, coverage, and management system.

B. Perform the following field adjustments, tests, and inspections and prepare test reports:
   1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance.

C. Remove and replace malfunctioning units and retest.

D. Provide copies of test results to the Engineer.

3.06 PROTECTION

A. Protect finished installation until final acceptance of the project.

3.07 DEMONSTRATION

A. Provide training to Owner's representative. Provide 2 hours of training. Refer to Division 01 Section "Demonstration and Training"

3.08 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of distributed antenna systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Contractor or installer will provide.

END OF SECTION

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SECTION 28 31 20
DISTRIBUTED ANTENNA SYSTEM (INTERNAL COMMUNICATION)

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 performance requirements and products for a four-channel bi-directional repeater system. A bi-directional radio frequency (RF) repeater will be required inside the building. Antennas will be installed in and out of the building to transmit and receive the radio signals. The system shall ensure full building coverage for the two-way communications services in the area. All required cabling shall be provided for a complete and functional system. The Contractor shall provide a fully functional Distributed Antenna System compliant with national and local requirements and the following specifications. Contractor shall provide license for operation.

1.03 IN-BUILDING DISTRIBUTED ANTENNA SYSTEM SPECIFICATION

A. Description: For purposes of this specification, a distributed antenna system (DAS) is an in-building Wireless system facilitating frequencies as required by Life Time system, designed to serve internal communication services. The system antenna design and layout shall be engineered and configured to meet national and local requirements. Calculation shall be provided for each supported service, to verify the signal levels required to maintain the specified reliability and coverage objectives.

B. The in-building Distributed Antenna System (DAS) solution must be implemented with proven, type- accepted, state of the art technology.

C. The DAS system proposed by the Contractor must comply with the following design, coverage and reliability requirements:
   1. Active Signal Handling
      a. The in-building DAS shall have active powered elements that filter and amplify signals on a band specific basis to consistently deliver wireless services at the appropriate power levels.
   2. Signal Distribution
      a. The in-building DAS shall utilize a coaxial distribution cable with passive, broadband antennas in the distribution area.
   3. Centralized Power
      a. The in-building DAS system shall be powered through a local UPS.
   4. Delivered Audio Quality (DAQ) level shall be 3.4 or above. DAQ 3.4 is defined as “speech understandable without repetition. Some noise/distortion present.”

D. Acceptance Testing Procedure
   1. Upon completion of installation, The Contractor shall have the radio system tested to ensure that two-way communications coverage in the building and on each floor meets the specified performance requirements. Each floor of the building shall be divided into a grid of 20 equal squares or a grid spacing of no more than 50 feet by 50 feet. Signal level measurements shall be made using a test receiver with sensitivity and thermal noise floor approved by taking at least one sample measurement of the radio system control channel within each accessible grid location.
   2. Ensure all documentation is ready for final inspection.

a. Document all plots for transmission lines. Show that the Time-Domain Reflectometer (TDR) instrument is calibrated to NIST specifications.
b. Provide a chart showing loss for each transmission line.
c. Provide all engineering calculations in plan set.
    1) Link budget from interior antennas as well as link budget for the exterior antenna to the repeater. Include both downlink and uplink calculations.
d. Document downlink field strengths on the gridded off floor plan set.
e. Document and show downlink and uplink noise floor as measured with a spectrum analyzer.
f. Capture all Bi-Directional Repeater configuration pages and provide a copy in documentation.
g. Show on the air downlink plot from the spectrum analyzer as measured at the output of the repeater.

3. If the building fails to achieve the coverage requirement, the Contractor shall provide additional DAS equipment as required and conduct a new acceptance test.
4. Contactor shall pay all fees associated with testing the system.

1.04 RANGE OF SERVICE

A. Life Time Spectrum
1. The in-building DAS head end equipment shall be capable of supporting the spectrum, services, applications, and technologies required by Life Time.
2. System Overview
    a. System shall support 4 channel AWR D6000 digital two-way radios in use by Life Time.
    b. Coordinate the location of the radio DAS head end equipment with Life Time IT department to ensure proper MDF rack location.
    c. System shall serve all area of the Life Time Premises including parking area and outdoor amenities.
    d. IEEE 802.11 a/b/g/n will not be part of the DAS design.
3. The primary role of the DAS system is to provide radio communications. As such, reliability should be a primary goal of the design.
4. Recommended Coverage Design Goal
    a. The radio system control channel signal level shall exceed —95dBm at 95% or more of the locations measured within each grid area. Equivalently, the service area reliability shall be 95% or greater on each floor of the structure.
5. Failure Detection
    a. DAS equipment shall have failure detection circuitry which provides detection of mechanical, electrical, and power failure of the DAS, as well as oscillation detection capability which will reduce the repeater output to zero in the event of a system oscillation. Detection of any failure shall result in a distinct audible notification at a constantly attended location approved by Life Time.

1.05 SUBMITTALS

A. Product Data:
1. Product Data for all items provided under this Section.
    a. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment
    b. Indicate how the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.

c. Highlight with yellow or blue marker, or indicate with arrow stamp, adequate information to demonstrate materials being submitted fully comply with contract documents.
d. Indicate listing by UL or other approved testing agency.
e. Manufacturers' Cable Installation Instructions

B. System Block Diagram: Provide a block diagram illustrating system components and connectivity requirements. At a minimum label: cabling requirements, electrical requirements, and related system components. Include detailed diagrams of head end and rooftop equipment.

C. Operation and Maintenance Data: For system components to include in emergency, operation, and maintenance manuals.

D. Shop Drawings
1. Provide detailed plan views (minimum scale 3/32"=1'-0") and elevations of all telecommunications spaces showing field conditions, ancillary room components, dimensions, equipment racks, termination blocks, patch panels, cable paths and workspace requirements for access to equipment and cable connections.
2. Ratings of items.
3. Fire rating of room penetrations.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
5. Provide plan drawings of each floor of each building showing:
a. Routing for all cables installed under this Specification.
6. Reports and Schedules
a. Provide Cable Termination Schedules for all cables installed under this work, with the following information:
1) Backbone cables
2) Horizontal (antenna) distribution cables
7. Provide sample reports showing the proposed format for cable test reports.

E. As Built Drawings: The Contractor shall provide a complete set of as-built drawings.

F. Permits: Contractor shall obtain and submit required permitting for the installation of the system. Contractor shall provide all required submittals to the local authority having jurisdiction and the Fire Department. Contractor shall fill out and provide design and engineering specifications per local requirements to obtain permit.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. The installation shall be performed by a company that has been in the business of installing DAS systems for a period of at least three years.

C. Response times for remote diagnostics shall be within two hours, on site diagnostics within 5 days, and parts availability / service restoration within 10 days.

D. References: Provide manufacturer references for five projects of a similar size / scope where the system proposed is currently installed. Provide contact information at each site as well as any written recommendations available.

E. 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.

F. Comply with NFPA 70 for components and installation.

G. Comply with local Fire Code.

1.07 WARRANTY

A. Provide a warranty of 2 years from substantial completion.

PART 2 - PRODUCTS

2.01 EQUIPMENT MANUFACTURERS

A. All equipment shall be the product of a manufacturer that has been in the business of manufacturing like product and financially stable for a period of at least five years. The Contractor shall provide equipment references as required in the request for proposals for any substitutions.

B. The Contractor shall commit, in writing, to factory support for the primary components of the DAS system, providing hardware availability and support for a minimum period of ten years following system implementation. The primary components shall include all equipment by a single or multiple manufacturers, totaling at least 70% of the capital equipment cost.

2.02 PARTS AND EQUIPMENT SPECIFICATIONS

A. Contractor shall provide parts and equipment list, and specifications for all components of the system, including:
   1. Kenwood rack mount repeaters, head end equipment.
   2. Interior Antennas.
   3. Exterior antennas.
   4. Four channel coaxial hybrid combiner and terminators.
   5. Hybrid coupler.
   6. Shielded Coaxial Cable and connectors.
   7. Lightning arrester.

2.03 REPEATER

A. Frequency range: 450-520 MHz.

B. One repeater for each channel up to four-channel.

C. Technology:
   1. Digital/analog repeater with channel filtering.

D. Input and output impedance: 50 ohms.

E. Enclosure: NEMA 4.

F. Additional outputs: System shall have alarm output.

G. Repeater shall include re-tunable or replaceable filters to accommodate pass band changes. The use of non-adjustable and non-replaceable RF duplexer filters is prohibited.

2.04 ANTENNAS

A. Exterior Antenna: Per site requirement.

B. Interior Omni-directional antenna: Per site requirement.

2.05 HYBRID COMBINERS AND COUPLERS

A. It shall cover entire RF range and provide power split ratio proper for balancing the signal strength through the signal distribution network.

2.06 WIRING AND CABLES

A. Coax: 1/2” coax transmission line.
   1. Jack material: PE.
   2. Outer conductor material: Corrugated copper.
   3. Dielectric material: Foam PE.
   4. Inner conductor material: Copper-clad aluminum wire.
   5. Jacket color: Black.
   6. Cable shall be plenum rated.

2.07 LIGHTNING PROTECTION DEVICE

A. Provide lightning protection equipment on cabling entering the building from the exterior antenna. Ground antenna to building grounding system

2.08 SPARE MATERIALS

A. Furnish spare 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 not less than one of each item listed below. Deliver extra materials to Owner.
   1. Antennas: One of each type installed.
   2. Passive Components (taps, combiners, splitters, couplers, etc.): One of each type installed.
   3. Cable: 100 feet (30 m); each type used
   4. Jumper Cables: Two for every type installed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The installation shall be performed by a company that has been in the business of installing DAS systems for a period of at least three years.

3.02 COORDINATION

A. Design coordination is required for this Work. Coordination with General Contractor and the design team is required to address system integration and structure cabling design.

B. Coordinate Work of this Section with on-site General Contractor and their sub-contractors.

C. Coordinate layout and installation of distributed antenna system equipment and antenna cable with other construction that penetrates ceilings or is supported by them, including but not limited to light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

D. Coordinate locations of any equipment that differs from that shown on the Construction Documents with the Engineer and Owner prior to installation. All difference shall be clearly, noted in the submittals. Special consideration shall be taken to install antennas in areas with the least visual impact. All cabling shall be concealed wherever possible and adequately supported.

E. Coordinate installation and system level measurement with engineer, Owner, vendors and installation contractors.

3.03 CABLE INSTALLATION

A. Coaxial cable, and other associated cable and wiring shall be installed in sleeves indicated on the Construction Documents for antenna system. Provide proper support for all cabling. Cabling shall be installed in a neat and workmanlike manor. Any cabling deemed by the Engineer to be improperly installed or improperly supported shall be fixed by the Contractor at no expense to the Owner. Provide j-hooks where cable trays are not present and install cabling in conduit where installed in exposed finished areas.

B. Coaxial cables are to be terminated at bulkheads in each designated equipment room. Provide proper grounding on each bulkhead.

C. Contractor will provide as-built documentation of the installed cable system.

3.04 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

B. All installed cable shall be labeled "INTERNAL RADIO DISTRIBUTED ANTENNA SYSTEM CABLE "every twenty feet.

3.05 FIELD QUALITY CONTROL

A. Contractor shall provide detailed documentation specifying test procedures for installed cabling, antennas, repeaters, coverage, and management system.

B. Perform the following field adjustments, tests, and inspections and prepare test reports:
   1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance.

C. Remove and replace malfunctioning units and retest.

D. Provide copies of test results to the Engineer.

3.06 PROTECTION

A. Protect finished installation until final acceptance of the project.

3.07 DEMONSTRATION

A. Provide training to Owner's representative. Provide 2 hours of training. Refer to Division 01 Section "Demonstration and Training".

3.08 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of distributed antenna systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Contractor or installer will provide.

END OF SECTION

SECTION 28 31 29
AREA OF REFUGE/RESCUE ASSISTANCE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Area of refuge/rescue assistance emergency communication system and associated call stations, control stations, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 34 - Conduit for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for area of refuge/rescue assistance system components.
   2. Coordinate the work with other installers to provide communication lines required for control station timed automatic connection to designated constantly attended monitoring location.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install call stations and control station(s) until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams.

D. Design Data: Include standby battery calculations.

E. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements listed below.

B. Comply with the following:
1. ADA Standards.
2. NFPA 70 (National Electrical Code).
3. NFPA 101 (Life Safety Code).
4. The requirements of the local authorities having jurisdiction.
5. Applicable TIA/EIA standards.

C. Manufacturer Qualifications: Company engaged in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company with minimum three years documented experience with similar area of refuge/rescue assistance systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer.

F. Products: Listed, classified, and labeled as suitable for the purpose intended.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Area of Refuge/Rescue Assistance Communication System:
1. Basis of Design: Rath Microtech, model(s) as indicated on plans.

2. Subject to compliance with specified requirements of the section and prior approval, one of the following:
    a. Cornell Communications: www.cornell.com
    b. Code Blue: www.codeblue.com
    c. Alpha Communications; www.alphacommunications.com

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 AREA OF REFUGE/RESCUE ASSISTANCE COMMUNICATION SYSTEM

A. Provide new area of refuge/rescue assistance communication system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description:
1. Call Stations: Located at each designated area of refuge/rescue assistanceas indicated on drawings, unless otherwise directed by authorities having jurisdiction.
2. Master Control Station: New, located as indicated on drawings, unless otherwise directed by authorities having jurisdiction.
3. System battery backup is required.
4. Timed automatic connection to designated constantly attended monitoring location is required.

C. System Operation:
1. When a call for assistance is initiated at call station:
    a. Provide audible and visual notification at call station to confirm that call has been placed.
    b. Provide audible and visual notification at control station(s) that call has been placed and annunciate the location of the call station/zone that initiated a call.
    c. Maintain visual notification of each call location at control station(s) until manually reset by control station operator.
    d. Maintain audible notification at control station(s) that call(s) have been placed until call is acknowledged by control station operator.
    e. Maintain visual notification at call station until manually reset by control station operator.
2. When a call for assistance is acknowledged at control station:
    a. Provide visual notification at control station that call has been acknowledged.
    b. Provide visual notification at call station that call has been received.
    c. Establish two-way voice communication between call station and control station.
3. When a call has not been acknowledged during a programmed time delay to allow for local response, automatically initiate call to listed remote monitoring station under contract with facility and establish two-way voice communication.

D. Call Station(s):
1. Suitable for the environment where installed.
2. Finish: Stainless steel.
3. Mounting: Flush-mounted.

4. Button engraved: PUSH FOR HELP.
5. Provides means to initiate call for assistance.
6. Provides for distinct audible and visual notification to confirm that call has been placed and for distinct visual notification that call has been acknowledged.
7. Following initial call for assistance, provides for hands-free two-way communication with control station(s).

E. Control Station(s):
1. Suitable for the environment where installed.
2. Mounting: As indicated on drawings.
3. Provides visual notification that system is operational.
4. Provides for distinct audible and visual notification of calls with annunciation of call station/zone locations.
5. Provides for two-way communication with selected call stations.
6. Provides for supervision of system wiring and provides distinct audible and visual notification of faults.
7. Audible Notification Sound Level: Not less than 90 dB.

F. Accessories:
1. Provide components as indicated or as required for a complete operating system.
2. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components, and in accordance with wiring methods indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that characteristics of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Mounting Heights:
1. Call Stations: Comply with applicable accessibility requirements.
2. Control Stations: As indicated on drawings.

D. Wiring Method:
1. Use listed plenum rated cables in spaces used for environmental air.
2. Install wiring in conduit where required for rough-in, where required by authorities having jurisdiction, and where exposed to damage.
3. Conduit: Comply with Section 26 05 34.

E. Provide grounding and bonding in accordance with Section 26 05 26.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

G. Identify system wiring and components in accordance with Section 26 05 53.

H. Identify zones at control station(s) to indicate call station locations.

I. Provide required instructional signage at each call station.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Test to verify wiring is free of shorts and grounds.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Test system for proper operation.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of area of refuge/rescue assistance system for one year from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

B. Provide trouble call-back service upon notification by Owner:
   1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

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SECTION 31 00 10
DIVISION 31 TABLE OF CONTENTS

1.01 DIVISION 31 – EARTHWORK

31 10 00 - Site Clearing
31 23 00 - Excavation and Fill
31 23 19 - Dewatering

END OF SECTION

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants and grass to remain.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting and capping or sealing site utilities.
6. Temporary erosion and sedimentation control measures.

1.2 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.

1.3 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. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PRODUCTS

1.4 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 2 - EXECUTION

2.1 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.

2.2 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 Sediment and Erosion Control Drawings.

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.

2.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

2.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. 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.

2.5 CLEARING AND GRUBBING

A. 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.

2.6 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.

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.

2.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

2.8 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 nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities and abandoning site utilities in place.
   7. Temporary erosion- and sedimentation-control measures.

1.02 RELATED SECTIONS

A. Section 00 31 00 – Available Information.

B. Section 02 41 00 - Selective Site Demolition.

1.03 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally 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 (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 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 Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Refer to Section 31 23 00 Excavation and Fill. If materials are not indicated there, refer to Soils Report and Coordinate with Architect.
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
   2. Contractor to provide documentation that all imported materials are environmentally clean.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.
   1. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 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 erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls with approval from the AHJ and restore and stabilize areas disturbed during removal

3.03 TREE AND PLANT PROTECTION

A. Protect existing trees and plants to remain by marking and enforcing landscape protection areas.
   1. Size construction limits as recommended for size and type of plant.
   2. Do not dig, store materials, pile earth, drive or park vehicles within the limits.
   3. See Section 31 23 00 for more requirements for landscape protection areas.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect/Engineer.

3.04 EXISTING 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 utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting 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 2 days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's/Engineer's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Install Phase I Erosion and Sediment Controls prior to any land disturbing activities.

B. Remove obstructions, trees, shrubs, 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. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
   3. Use only hand methods for grubbing within protection zones.

C. 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 (200 mm), and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on Drawings or to a minimum depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Height of topsoil stockpiles not to exceed 72 inches (1800 mm) unless approved otherwise in advance.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated and as necessary for all new construction.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. 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.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

C. Comply with all federal, state and local regulations associated with disposal of material removed from the site.

END OF SECTION

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for asphalt paving and concrete pavement and walks.
5. Excavating and backfilling for utility trenches.

B. Related Sections:
1. Project Geotechnical Report

1.2 DEFINITIONS

A. Backfill: Soil 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 and concrete pavement and walks.

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 changes in the Work.
2. 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. 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.

I. Subbase Course: Course placed between the subgrade and base course.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 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.

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: 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.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 and 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.

D. Subbase Material: Naturally or artificially graded mixture of crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 15 percent passing a No. 200 sieve.

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 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed 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.

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.

3.2 EXCAVATION

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.

3.3 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.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

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. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. 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.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 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.

3.8 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.

3.9 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 bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Place and compact initial backfill of subbase material, 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.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.10 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 satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 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.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 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.

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 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact 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 recompact 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 95 percent.

3.13 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.

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.

3.14 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. Shape subbase and base course to required crown elevations and cross-slope grades.
2. 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 1557.

3.15 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. 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.
2. 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.

3.16 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.

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.

3.17 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.

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.

3.18 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.

END OF SECTION 312000

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Aggregates.
   6. Subbase course for asphalt paving.
   7. Subsurface drainage backfill for walls and trenches.
   8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.02 RELATED SECTIONS

A. Section 00 31 00 – Available Project Information: Geotechnical Report.

B. Section 31 10 00 - Site Clearing.

1.03 UNIT PRICES

A. Aggregate Materials, per cubic yard.

B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
   1. 24 inches (600 mm) outside of concrete forms other than at footings.
   2. 12 inches (300 mm) outside of concrete forms at footings.

1.04 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: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer 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: Aggregate layer 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/Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D1586.

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: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Geofoam.
   4. Warning tapes.

B. Qualification Data: For qualified testing agency.

C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D698.

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 earth moving operations. Submit before earth moving begins.

E. Contractor to provide delivery slips to the Architect/Engineer for materials used.

F. Contractor to provide certification that all imported materials are environmentally clean.

1.06 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

B. Pre-Excavation Meeting: Conduct meeting at Project site.

1.07 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving 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 Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service provider a minimum of 72 hours before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 2 - Selective Site Demolition, are in place.

D. Do not commence earth moving operations until plant-protection measures specified in Division 2 Section - Selective Site Demolition are in place.

E. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.

5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials imported to the site are to be environmentally clean. Contractor to maintain manifest of all materials imported on to the site.

2.02 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 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.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.03 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven 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. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D4751.
   3. Permittivity: 0.5 per second, minimum; ASTM D4491.

2.04 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
   1. Portland Cement: ASTM C150, Type I.
   2. Fly Ash: ASTM C618, Class C or F.
   3. Normal-Weight Aggregate: ASTM C33, 3/4 inch (19-mm) nominal maximum aggregate size.

B. Produce conventional-weight, controlled low-strength material with 80 psi (550-kPa) compressive strength when tested according to ASTM C495.

2.05 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
   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

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 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.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 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.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches (600 mm) outside of concrete forms other than at footings.
      b. 12 inches (300 mm) outside of concrete forms at footings.
      c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.

f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). 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 (150 to 300 mm) 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 (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots according to requirements in Division 2 Section "Tree Protection and Trimming."

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 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 (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

D. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots according to requirements in Division 2 Section "Tree Protection and Trimming."

3.08 SUBGRADE INSPECTION

A. Notify Project Manager when excavations have reached required subgrade.

B. If Project Manager 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 a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) 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 (5 km/h).

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Project Manager, and replace with compacted backfill or fill as directed.
3. Proof roll subgrade under area of porous pavement in accordance with porous pavement manufacturer's recommendations

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Project Manager, without additional compensation.

3.09 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 (17.2 MPa), may be used when approved by Project Manager.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Project Manager.

3.10 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.
2. Provide filter fabric fencing around stock pile areas.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, subdrainage, 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.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow and 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. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section Cast-in-Place Concrete.

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit with less than 18" of cover below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 3 Section Cast-in-Place Concrete.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 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 satisfactory soil 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.

3.14 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.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. All fill and backfill in structural areas, such as building, parking deck, pavement, and sidewalk areas, should be placed in maximum nine-inch loose lifts and compacted to 93 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor).

B. Fill placed within landscaped areas may be placed and compacted to 85 percent of the maximum dry density within three percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor).

C. A sheep's foot roller shall be used to compact the on-site soils or a small hand-held vibratory compactor within excavations.

3.16 STRUCTURAL FILL TESTING

A. Before filling operations begin, representative samples of each proposed fill material shall be collected. The samples shall be tested to determine the maximum dry density, optimum moisture content, natural moisture content, gradation, and plasticity of the soil prior to construction in order to avoid construction delays. These tests are needed for quality control during compaction, and also to determine if the fill material is acceptable.

B. The placement of fill and backfill shall be monitored by a qualified engineering technician to ensure that the specified material and lift thicknesses are properly installed. The following frequency of in-place density tests shall be performed to ensure that the specified compaction is achieved throughout the height of the fill or backfill:
1. Building and Pool Areas – One compaction test per 2,500 square feet of building footprint, for each lift.
2. Pavement Areas – One compaction test per each 10,000 square feet of pavement area, for each lift.
3. Utility Trenches – One compaction test per each 150 linear feet of trench, for each lift.

4. Landscaped Areas – One compaction test per each 20,000 square feet, for each lift.
5. All areas – One moisture content test per 5,000 square feet, for each lift.

3.17 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 Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Walks: Plus or minus 1 inch (25 mm).
   3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.18 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
   1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow and ice.

B. On prepared subgrade, place subbase course 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.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase course and base course to required crown elevations and/or cross-slope grades.
   4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   6. Compact subbase course 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 D698.

3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, and 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 (150 mm) or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) 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 D698.

3.21 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2922, and ASTM D2937, 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 one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two 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 materials to depth required; recompact and retest until specified compaction is obtained.

3.22 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 Project Manager; reshape and re-compact.

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.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

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SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Construction dewatering.

1.02 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
   1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
   5. Remove dewatering system when no longer required for construction.

B. Dewatering activities are to comply with requirements of the Soil Conservation District (SCD).

1.03 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
   1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
   2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

B. Qualification Data: For qualified Installer.

C. Field quality-control reports.

D. Other Informational Submittals:
   1. Photographs: Show existing conditions of adjoining construction and site improvements that could be misconstrued as damage caused by dewatering operations.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA and SCD notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-Installation Meeting: Conduct meeting at Project site.
   1. Review methods and procedures related to dewatering including, but not limited to, the following:
      a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
      b. Geotechnical report.
      c. Proposed site clearing and excavations.
      d. Existing utilities and subsurface conditions.
      e. Coordination for interruption, shutoff, capping, and continuation of utility services.
      f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

g. Testing and monitoring of dewatering system.

1.05 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/Engineer no fewer than two days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Architect's/Engineer'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 this data.
   1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
   2. The geotechnical report is included elsewhere in the Project Manual.

C. Survey Work: Engage a qualified professional land surveyor licensed to practice in California to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, pavement subgrades and porous pavement area, from ponding on prepared subgrades, and from flooding site and surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system 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. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 1 Section "Temporary Facilities and Controls" Division 2 Section "Site Clearing" during dewatering operations.

3.02 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
   1. Space well points or wells at intervals required to provide sufficient dewatering.
   2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
   1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
   1. Maintain piezometric water level a minimum of 24 inches (600 mm) below surface of excavation.

E. Dispose of water removed by dewatering in a manner that complies with requirements of the SCD and avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
   1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.03 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
   1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
   2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
   3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

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SECTION 32 00 10
DIVISION 32 TABLE OF CONTENTS

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 13 13 - Concrete Paving
32 14 00 - Unit Paving
32 17 23 - Pavement Marking
32 18 23 - Synthetic Field Sport Surfacing
32 18 25 - Athletic Surfacing
32 31 19 - Decorative Metal Fences and Gates
32 33 00 - Site Furnishings
32 35 15 - Landscape Shade Tops
32 35 16 - Outdoor Shade Structures
32 84 00 - Planting Irrigation
32 92 00 - Turf and Grasses
32 93 00 - Plants

END OF SECTION

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 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. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.2 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. Material Certificates: For each paving material, from manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of local DOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 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. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, AC10 - for on-site pavement. Coordinate with authority having jurisdiction for pavement in public right-of-ways.

B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: As indicated.

C. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Surface Course: ½" Mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches, unless otherwise noted.

3.3 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.

1. 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.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

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: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

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. Spread mix at minimum temperature of 250 deg F.
2. 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.

C. 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. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. 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."

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: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 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. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. 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 thickness indicated within the following tolerances:
1. Surface Course: Plus 1/4 inch, no minus.

B. 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:

1. Surface Course**:** 1/8 inch.
2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for **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.

3.10 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 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.

END OF SECTION 321216

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 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.

B. Related Sections:
1. Division 31 Section "Earth Moving" for aggregate subbase and base courses.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete pavement mixture.

1.3 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.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Plain Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type II

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, 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.

2.3 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.

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.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.4 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. Joint Sealant- Prosoco LS and Prosoco Salt Guard

C. 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: As indicated.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Air Content: 5 to 7 percent.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared base surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 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.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

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.

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.

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.

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.

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.

F. Sealant: Apply Prosoco LS and Prosoco Salt Guard to all joints after concrete is propery cured.

3.5 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. 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.

D. Screed pavement surfaces with a straightedge and strike off.

E. 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.

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.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.7 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, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before water has disappeared from surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

3.8 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. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.9 PAVEMENT MARKING

A. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.

B. Sweep and clean surface to eliminate loose material and dust.

C. 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.

3.10 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. Exclude traffic from pavement for at least 14 days after placement.

C. 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 321313

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Driveways
   2. Roadways
   3. Parking lots
   4. Curbs and gutters
   5. Walks

1.02 REFERENCE STANDARDS

1.03 RELATED SECTIONS

A. Section 00 31 00 - Available Project Information.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 20 00 - Concrete Reinforcement.

F. Section 03 30 00 - Cast in Place Concrete.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Qualification Data: For qualified ready-mix concrete manufacturer.

E. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.

1.05 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Form Material: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required.

B. Reinforcing Steel: Provide per Section 03 20 00.

C. Concrete and Aggregates: Provide concrete to comply with Section 03 30 00.

D. Water: Potable and complying with ASTM C94/C94M.

E. Joint Fillers: ASTM D1751, 1 inch thick asphalt-saturated cellulosic fiber in preformed strips.

2.02 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned per ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 4,500 psi (27.6 MPa)
      a. Curbs, Gutters, and Walks: 4,500 psi (20.7 MPa).
      b. Heavy-Duty Concrete Paving: 4,500 psi (27.6 MPa), 7 inches thick.
      c. Standard Concrete Paving: 4,500 psi (27.6 MPa), 5 inches thick.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45 unless indicated otherwise.
   3. Slump Limit: 4 inches (102 mm), plus or minus 1 inch (25 mm), unless indicated otherwise.

2.03 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with Section 03 30 00. Measure, batch, and mix concrete materials and concrete per ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in Work.
   1. When air temperature is between 85 and 90 degrees F (30 and 32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 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.
   1. Provide grade stakes at a minimum spacing of 25 feet. Provide 1/4 inch crown or cross slope in direction indicated on the drawings. Pitch walks as indicated on Drawings and per guidelines of the AHJ. Make adjustments in slopes at walk intersections to provide positive drainage. Install sufficient quantity of forms to allow continuous progress of Work.
   2. Check completed form Work for grade and alignment.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI (DA4) "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement, and with Sections 03 20 00 and 03 30 00.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.04 JOINTS:

A. General: Form construction, isolation, and contraction joints and tool edges 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 paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/4 inch (6 mm) or more than 1 inch (25 mm) 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 1-piece lengths. Where more than 1 length is required, lace or clip joint-filler sections together.

D. Control Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least 1/3 of concrete thickness.
   1. Spacing: Install control joints at a maximum of 15 feet on center.
   2. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4 inch (6 mm) radius. Repeat grooving of control joints after applying surface finishes.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4 inch (6 mm) radius. Repeat tooling of edges after applying surface finishes.

3.05 CONCRETE PLACEMENT

A. General: Comply with the requirements of Division 3 Sections for mixing and placing concrete, and as herein specified.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes and other structures until they are at required finish elevation and alignment.

C. 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. If placement operations are interrupted for more than 1/2 hour, place construction joint.

D. Consolidate concrete per ACI 301 (ACI 301M) 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.
   2. When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

E. Cold-Weather Placement: Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 degrees F (4.4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) 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 design mixtures.

F. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F (32 degrees C) at time of placement. Chilled mixing water or chopped ice may be used to control

temperature, provided water equivalent of ice is calculated in 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.

3.06 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin 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. 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.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Comply with ACI 306.1 for cold-weather protection.
   2. Provide protection to maintain allowable temperatures for a minimum of 5 days after placement.
   3. Replace concrete damaged by frost action at no additional cost to Owner.

B. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows and as indicated in Section 03 30 00. Use moist-curing methods for initial curing whenever possible.
   1. Moisture Curing: Keep surfaces continuously moist for not less than 7 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 (305 mm) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (305 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows, unless indicated otherwise:
   1. Elevation: 3/4 inch (19 mm).
   2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
   3. Surface: Gap below 10 foot (3 m) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
   6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
   8. Joint Spacing: 3 inches (75 mm).
   9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
   10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.09 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 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 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 concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove Work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than 2 days before date scheduled for Substantial Completion inspections.

END OF SECTION

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SECTION 32 14 00
UNIT PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete pavers set in aggregate setting beds.
   2. Joint sand.
   3. Plastic edge restraints.
   4. Cast-in-place concrete edge restraints.

1.02 RELATED SECTIONS

A. Section 00 31 00 - Available Data, including Geotechnical Report.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 32 13 13 - Concrete Paving.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Pavers.
   2. Edge restraints.
   3. Paver Joint Sand.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Verification:
   1. Full-size units of each type of unit paver indicated.
   2. Joint materials.
   3. Exposed edge restraints.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store pavers 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.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.06 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.07 WARRANTY

A. Manufacturer to supply a 3 year product warranty for concrete paver and concrete edger products.

B. The use of deicer on the pavers shall not void the manufacturer’s warranty.

PART 2 PRODUCTS

2.01 CONCRETE PAVERS

A. Concrete Pavers: Solid paving units complying with ASTM C936 and resistant to freezing and thawing when tested per ASTM C67, made from normal-weight aggregates.
   1. Approved Manufacturers: (Submit samples to match specified paving unit for architect approval match Architect's sample.)
      a. Belgard
         (Oldcastle Architectural, Inc.)
         375 Northridge Road, Suite 350
         Atlanta, GA 30360
         (800) 899-8455
         (770) 804-3363
         (770) 804-3369 (Fax)
         E-mail: belgard@oldcastleapg.com
      b. No substitutions.
   2. Products:
      a. PV-3 - Pool Deck and other Pedestrian Walkways:
         1) Pavers: Belgard; Dimensions Pavers.
         2) Thickness: 2-3/8 inches (60 mm). (at all pedestrian traffic areas)
         3) Face Size and Shape:
            (a) Field: 3 piece Dimensions 12; 6" x 12", 12" x 12", 18" x 12".
            (b) Border: 9" x 6"
         4) Color:
            (a) Field Color: Scandina Gray.
            (b) Accent Color: Bourbon.
         5) Pattern: Manufacturer's Pattern C.

2.02 CURBS AND EDGE RESTRAINTS

A. Plastic Edge Restraints: 1-piece high density polyethylene (HDPE) edging with spikes every 4 inches on center.
   1. Manufacturer:
      Snap Edge Corporation
      3925 Stern Avenue
      Charles, IL 60124
      (800) 932-3343
   2. No Substitutions.

2.03 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D1056, Grade 2A1.

2.04 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Subbase: Sound, crushed stone or gravel complying with requirements in Division 31 for subbase material.

B. Graded Aggregate for Base: Sound, crushed stone or gravel complying with requirements in Division 31 for base course.

C. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C33 for fine aggregate.
   1. Sieve per ASTM C136 and CSA-A23.2A.
   2. Conform to the grading requirements of Table 2, Grading Requirements for Bedding Sand, ASTM C33 and CSA A23.1-M94.

D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.
   1. Techni-Seal HP Next Gel Polymeric Sand; dry mix, containing polymeric binding agent, activated with water.
   2. Color: To match adjacent paver unit. Submit color samples to architect for approval from manufacturer's full range of color options.
   3. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

2.05 COMPRESSIVE STRENGTH

A. At the time of delivery to the work site, the average compressive strength of the paver shall not be less than 8,000 psi, with no individual unit less than 7,200 psi. Testing procedures shall be in accordance with ASTM C140 specifications.

2.06 ABSORPTION

A. The average absorption shall not be greater than five percent (5%), with no individual unit result greater than seven percent (7%) per ASTM C140 specifications.

2.07 RESISTANCE TO FREEZING AND THAWING

A. The manufacturer shall satisfy the purchaser by laboratory testing that the paving units have adequate resistance to freezing and thawing per ASTM C67-83 specifications. The specimens shall have no breakage and not greater than one percent (1%) loss in dry weight of any individual unit when subjected to 50 cycles of freezing and thawing.

2.08 DIMENSIONAL TOLERANCES

A. Pavers shall be prismatic in plan and formed with straight, uniform edges. The tolerance for the flat portions of the sides shall not exceed 1/32" as measured with a steel straight edge. "Slumped" pavers exceeding this tolerance will be rejected. The length, width and thickness of the paving stones shall meet the allowable tolerances specified in ASTM C936.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

C. Proof-roll prepared subgrade according to requirements in Division 2 Section "Earthwork" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.

3.03 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
   1. For concrete pavers, a block splitter may be used.

D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.

E. Joint Pattern: "Herringbone."

F. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

G. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 7 Section "Joint Sealants."

H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
   1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.

I. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.

3.04 AGGREGATE SETTING-BED APPLICATIONS

A. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).

B. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

C. Treat leveling course with herbicide to inhibit growth of grass and weeds.

D. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
   1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

E. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
   1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of un-compacted pavers adjacent to temporary edges.
   2. Before ending each day's work, compact installed concrete pavers except for 36-inch (900 mm) width of un-compacted pavers adjacent to temporary edges (laying faces).
   3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
   4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with non-staining plastic sheets to protect them from rain.

F. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

G. Do not allow traffic on installed pavers until sand has been vibrated into joints.

H. Repeat joint-filling process 30 days later.

3.05 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

END OF SECTION

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SECTION 32 17 23
PAVEMENT MARKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Division 1 of the Specifications for the Fitness Center portion of the development apply to the Work in this Section.

1.02 WORK INCLUDED

A. The work of this Section included furnishing all material, labor, equipment and services to paint the following items of the types, patterns, sizes and colors as indicated on the Drawings.
   1. Parking stripes.
   2. Traffic arrows.
   3. Walkway stripes.
   4. Text.
   5. ADA accessible space logo.

1.03 RELATED WORK

A. The following Work is related to this Section:
   1. Section 01 33 00 - Submittals Procedure.
   2. Section 01 40 00 - Quality Requirements.
   3. Section 01 60 00 - Product Requirements.
   4. Section 03 30 00 - Cast-in-Place Concrete.
   5. Section 32 13 13 - Concrete Paving.

1.04 SUBMITTALS

A. Submit for review and approval Manufacturer's Spec Data Sheets of each product to be used.

B. Submit for record Material Safety Data Sheets of each product, solvent, or related chemicals to be used, and certification that the materials conform to local, state, and federal environmental and worker’s safety laws and regulations.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Manufacturer and Installer are required to confirm that all materials used in accordance with this Section conform to local, state, and federal environmental and workers' safety laws and regulations.
   1. VOC content of materials shall not exceed the limits per Environmental Protection Agency National Volatile Organic Compound Emission Standards for Architectural Coatings (40 CFR 59, Subpart D).

B. The Installer is solely responsible for fume control and shall take all necessary pre-cautions against injury to personnel or adjacent building occupants during application. As a minimum, Installer shall take the following precautions:
   1. Provide and maintain barricades.
   2. Locate and protect building air intakes during application.
   3. Follow all state, federal, and local safety regulations.
   4. Follow all Manufacturer's safety requirements.
   5. Dispose empty containers immediately and properly.
   6. Use protective equipment.
   7. Ensure work area is well vented to the exterior.

1.06 TRANSPORTATION AND HANDLING

A. Deliver all materials to site in original, unopened containers bearing the following information:
   1. Name of Product
   2. Name of Manufacturer
   3. Date of Manufacture
   4. Lot or Batch Number

B. Store materials under cover and protected from the weather.

C. Replace containers showing any signs of damage with new material at no additional cost to Owner.

D. Mix and prepare coatings only in areas designated by the Contractor for that purpose.

E. Take precautions to prevent fire in or around coatings materials. Provide and maintain hand fire extinguisher near storage and mixing area.

F. At no time shall the weight of the stored material placed on a slab area exceed 30 PSF or 2,000 lbs. over 20 square inches.

PART 2 PRODUCTS

2.01 PAVEMENT MARKINGS

A. All materials shall meet Federal Specification FS TT-P-1952 or MPI #32.

B. Provide pavement markings as indicated on the Drawings.
   1. Provide Waterborne pavement markings when conditions permit them to be applied.
      a. See Manufacturer's recommendations for required conditions.
   2. Provide Solventborne pavement markings when conditions are too cold for Waterborne markings.

C. Approved pavement markings:
   1. Setfast Waterborne Acrylic Traffic Marking Paint, The Sherwin Williams Company, Cleveland, Ohio.
      a. Colors:
         1) TM226 White.
         2) TM227 Yellow.
         3) Handicap Blue Use TM226 White as base and add tint.
   2. SetFast Solventborne Acrylic Traffic Marking Paint, The Sherwin Williams Company, Cleveland, Ohio.
      a. Colors:
         1) TM5626 White.
         2) TM5627 Yellow.
         3) Handicap Blue Use TM51626 White as base and add tint.
   3. Or approved equal.

2.02 PAVEMENT MARKING BEADS

A. All materials shall meet AASHTO M 247, Glass Beads used in traffic paints, Type I. Beads shall be treated with a performance adhesion coating.

B. Provide Glass Beads at a rate of 6 pounds per gallon into all traffic arrows, center traffic lines, walkway stripes and floor text to produce reflectorized pavement markings. Glass beads are not required in parking space striping.

C. Approved pavement marking bead manufacturers are:
   1. Cataphote Inc., Jackson, MS.
   2. Potters Industries Inc., Valley Forge, PA.
   3. Flex-O-Lite, St. Louis, MO.
   4. Or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Architect/Engineer as required in the General Conditions any conditions detrimental to the proper execution of this work.

B. Do not proceed until unsatisfactory conditions are acceptably remedied. Commencement of work implies acceptance of related work.

3.02 PREPARATION

A. Before commencing work, make certain that surfaces are clean, dry, and in sound condition.

B. Do not paint any surface which is wet or damp.

C. Remove all oil, dust, grease, dirt, and other foreign material to ensure adequate adhesion.

D. Any discrepancies, interferences or changes in striping due to field conditions to the Architect/ Engineer prior to painting. Paint Contractor shall be required to remove paint, repair surface and repaint stripes not applied in strict accordance with the Drawings and Specification.

E. Verify compatibility with concrete sealer, joint sealant, traffic bearing membrane, and all other surface treatments as specified in Division 7.

3.03 MIXING

A. Do not intermix different types of materials or materials from different Manufacturers.

B. Do not thin material except as recommended by Manufacturer for spray application.

C. Mix paint thoroughly by boxing, stirring or power agitation before use.

3.04 APPLICATION

A. Apply painting and finishing materials in accordance with the Manufacturer's directions. Use techniques best suited for the material and surfaces to which applied. Apply at 15 mils wet thickness.

B. Do not apply paint when the air and/or surface temperature is below 50 degrees F, when relative humidity exceeds 85%, when rain is threatening or late in the evening when dew might form before drying.

C. It is recommended to allow concrete to age 60 days (asphalt 90 days) before coating, when practical.

D. Parking space striping dimensions indicated on the Drawings are nominal dimensions. Tolerances shall be as follows:
   1. Parking space length shall equal indicated length ± 2 inches.
   2. Parking space width (or base line dimension) shall equal indicated width ± 2 inches.
   3. Striping shall extend to within not more than 3 inches from walls or other vertical surfaces.
   4. A string of parking spaces shall equal indicated dimension ± 2 inches per run.
   5. Stripe width shall equal 4 inches ± 1/2 inch.

E. For traffic arrows, walkways stripes, and floor text add glass beads on wet paint so that proper bead embedment and retention is achieved.

F. All markings shall be placed in a clean and professional manner.
   1. Lines shall be straight and clear.
   2. There shall be no overspray.
   3. Lines intersections shall be neat and square.

3.05 CLEANING

A. Immediately upon completion of work, clean up all paint spots, remove excess materials and equipment, and repair all paint damage to other finishes.

END OF SECTION

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SECTION 32 18 23
SYNTHETIC FIELD SPORT SURFACING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Outdoor Turf Systems.

1.02 RELATED SECTIONS

A. Section 00 31 00 - Available information (Geotechnical Report)

B. Section 01 31 00 - Project Management and Coordination.

C. Section 01 33 00 - Submittal Procedures.

D. Section 01 40 00 - Quality Requirements.

E. Section 01 60 00 - Product Requirements.

F. Section 32 18 25 - Athletic Surfacing.

1.03 REFERENCES

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).

C. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

D. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2022.

E. ASTM F1951 - Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment; Current Edition.

1.04 SYSTEM DESCRIPTION – OUTDOOR TURF SYSTEM

A. Performance Requirements: Provide a 2-layer (bottom layer rubber-polyurethane/top layer synthetic grass (without rubber infill) playground surfacing system that has been designed, manufactured and installed to meet the following criteria:
   1. Shock Attenuation (ASTM F1292):
      a. Gmax: Less than 200.
      b. Head Injury Criteria: Less than 1000.
   2. Flammability (ASTM D2859): Pass.
   3. Tensile Strength (ASTM D412): 60 psi (413 kPa).
   4. Tear Resistance (ASTM D624): 140%.
   5. Water Permeability: 0.4 gal/yd2/second.
   6. Accessibility: Comply with requirements of ASTM F1951.

1.05 SYSTEM DESCRIPTION – INDOOR TURF SYSTEM

A. Provide a 2-layer (bottom layer 3mm foam backing/ top layer broadloom tufted filament carpet)

1.06 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer’s product data and installation instructions.

C. Quality Assurance/Control Submittals: Submit the following:
   1. Certificate of qualifications of the playground surfacing installer.

D. Closeout Submittals: Submit the following:

1. Warranty documents specified herein.

1.07 QUALITY ASSURANCE

A. Qualifications: Utilize an installer approved and trained by the manufacturer of the playground surfacing system, having experience with other projects of the scope and scale of the work described in this section.

B. Certifications: Certification by manufacturer that installer is an approved applicator of the playground surfacing system.

1.08 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

1.09 PROJECT SITE CONDITIONS

A. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 90 degrees F (32 degrees C). Do not install in steady or heavy rain.

1.10 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
   1. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
   2. Warranty Period: 5 years from date of completion of work.

PART 2 PRODUCTS

2.01 TF-1: OUTDOOR TURF SYSTEM

A. Acceptable Manufacturers:
   1. Surface America, Inc.
      a. Contact: PO Box 157, Williamsville, NY 14231; Telephone: (800) 999-0555, (716) 632-8413; Fax: (716) 632-8324; E-mail: info@surfaceamerica.com; website: http://www.surfaceamerica.com.
   2. Xgrass Innovative Turf Solutions.
      a. Contact: 242 Duckworth Road, Dalton, GA 30721. Mark Prince Telephone (651)341-7763. mark.prince@xgrass.com.

B. Acceptable Products/Systems.
   1. Surface America: PlayBound TurfTop playground surfacing system.
   2. Xgrass: Xgrass Rec.

C. Components:
   1. Primer:
      a. By Manufacturer.
   2. Basemat:
      a. By Manufacturer.
      b. Material: Blend of 100% recycled resilient material.
      c. Thickness: As recommended by Manufacturer for playground applications, see details.
   3. Synthetic Turf:
      a. The synthetic turf material shall be in accordance with the following:
         1) The fiber shall be low friction fiber, measuring not less than 1-1/4" high. The low friction fiber shall be specifically designed to virtually eliminate abrasion.

2) The tufted fiber weight shall not be less than 70 ounces per square yard. The fiber shall be tufted on a 3/8" tufting machine at a rate of 3 stitches per inch minimum. The low friction non-abrasive fiber shall be treated with a UV inhibitor.
3) The primary backing shall consist of a one part, two or three component polyester/polypropylene or urethane backing with a minimum weight of 7 ounces per square yard. The secondary backing shall consist of an application of polyurethane (minimum of 20 ounces per square yard); heat activated to permanently lock fiber tufts in place. Products using latex based secondary backings will not be acceptable. The synthetic grass system shall be perforated with 3/16" holes every four (4") inches min in both directions to provide for maximum drainage. Complete synthetic grass system (including base pad) shall drain in excess of 15" per hour. Non-perforated systems shall not be acceptable alternates for purposes of this specification.
4) Granular fill (Optional):
   (a) Provide Granular fill if recommended by manufacturer for application.
   (b) Infill to be Acrylic Coated quartz with anti-Microbial properties. Xgrass Envirofill or equal.
   (c) Color to match turf.
   (d) Crumb rubber infill is not permitted.
5) The turf shall be delivered in Manfacturer's standard widths and lengths best suited for the project.
6) The fiber shall be field green in color to simulate natural grass as closely as possible and treated with UV inhibitor.

b. Boundary lines:
   1) Boundary lines (white) shall be painted as shown on drawings with paint recommended by turf manufacturer.

2.02 TF-X1: OUTDOOR TURF SYSTEM, IN-FILL SYSTEM

A. Manufacturer: Xgrass.
B. Product: Prime
C. Pile Height: 1 1/2”.
D. Face Weight 53oz.
E. Fiber Type: Omega Horseshoe
F. Color: Summer Blend.
G. Thatch: Green.
H. Infill System (By Alternate): Xgrass Envirofill. 3lbs/sf
I. Location: See Drawings

2.03 MIXES

A. Required mix proportions by weight:
   1. Basemat (outdoor turf system): 16+% polyurethane (as ratio: 14% polyurethane divided by 86% rubber). 14% polyurethane, 86% rubber (based on entire rubber & polyurethane mix).

PART 3 EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

A. Comply with the instructions and recommendations of the playground surfacing manufacturer.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions are suitable for installation of the playground surfacing system. New asphalt must be fully cured - up to 30 days. New concrete must be fully cured - up to 7 days.
B. Do not proceed with installation until unsuitable conditions are corrected.

3.03 PREPARATION

A. Surface Preparation:
   1. If asphalt or concrete base, using a brush or short nap roller, apply primer to the substrate perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).
   2. If crushed stone base, must be contained by wood or concrete border, which the material will abut.

B. Remove from the work site and replace material, which has deteriorated, or become contaminated in any way, prior to its application, at no additional expense to this contract. Dispose of waste materials legally, off site.

3.04 INSTALLATION

A. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, fencing, playground equipment installation and other relevant work, has been completed.

B. Basemat Installation (outdoor system):
   1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 10 ounces per cubic foot (466 kg/m3) to the specified thickness.
   2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traffic or equipment.
   3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

C. Synthetic Turf installation (outdoor system):
   1. Rough cut synthetic grass rolls for installation.
   2. Using 15" wide seam tape and 1-part urethane adhesive, seam synthetic grass rolls to form monolithic surface. Adhere synthetic grass to basemat around play area perimeter.
   3. If infill is included in system, using manual or machine-operated spreading equipment, distribute infill throughout synthetic grass installation to manufacturer's recommended depth.

3.05 PROTECTION

A. Protect the installed playground surface from damage resulting from subsequent construction activity on the site.

END OF SECTION

SECTION 32 18 25
ATHLETIC SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Recreational and high traffic surface for Outdoor Turf Area stoops.

1.02 RELATED SECTIONS

A. Section 00 31 00 - Available Project Information: Geotechnical Report.

B. Section 01 11 10 - Summary of Work.

C. Section 01 31 00 - Project Management and Coordination.

D. Section 03 30 00 - Cast-in-Place Concrete.

E. Section 32 18 23 - Synthetic Field Sport Surfacing.

1.03 SUBMITTALS

A. Product Data: Manufacturer’s descriptive literature for specified cushioned athletic recreational sport coatings.

B. Shop Drawings: Dimensional plans indicating layout of athletic recreational sports coatings.

C. Samples: Two (2) sets of color chips representing manufacturer’s full range of available color finishes to athletic recreational sports coatings.

D. Quality Assurance Submittals: Manufacturer’s printed installation instructions.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Minimum five (5) years documented experience producing athletic recreational sports coatings similar to those specified.
   2. Installer: Minimum five (5) years documented experience installing athletic recreational sports coatings similar to those specified.

1.05 DELIVERY, STORAGE & HANDLING

A. Acceptance at Site: Ensure materials arrive at the site in unopened and undamaged containers. Do not allow unacceptable materials to be used.

B. Storage: Keep material from freezing, store on pallets in a cool place; never in the hot sun.

1.06 PROJECT CONDITIONS

A. Existing Conditions: Examine areas where materials are to be installed, particularly the sub-base, drainage, compaction and levelness.

B. Ensure area to be surfaced is to be clear of any construction traffic, pedestrian traffic and any obstructions during application.

1.07 WARRANTY

A. Manufacturer’s Warranty: Manufacturer’s standard warranty against defects in products.

B. Installer’s Warranty: Installers standard warranty against defective workmanship.

PART 2 PRODUCTS

2.01 ATHLETIC SURFACING FOR OUTDOOR TURF AREA STOOPS

A. Manufacturer:

1. Ever Top - Surface America, PO Box 157, Williamsville, NY 14231
   Phone: (800) 999-0555, Fax: 716-64323-8324

B. Materials:
   1. Ever Top Primer Material: Urethane.
   2. Ever Top Flooring Surface:
      a. Material: Blend of recycled EPDM (ethylene propylene diene monomer) rubber and Aromatic urethane binder per manufacturer's recommendations.
      b. Required mix proportions by weight: 22% urethane (ratio: 18% urethane divided by 82% rubber). 18% urethane, 82% rubber (based on entire rubber & urethane mix).
      c. Thickness: Nominal 1/2" (12.7 mm), minimum 3/8" (9.5 mm), maximum 5/8" (15.9 mm).
      d. Custom color created with combination of 4 standard colors: Hunter Green, Bright Green, Dark Grey, and Eggshell - submit sample for review and approval.
   3. Dry Static Coefficient of Friction (ASTM D2047): 1.0.
   4. Wet Static Coefficient of Friction (ASTM D2047): 0.9.
   5. Dry Skid Resistance (ASTM E303): 89.
   6. Wet Skid Resistance (ASTM E303): 57.

C. Concrete Slab Requirements: Minimum thickness, typically 4" for non-weight bearing loads per the standard of the geographic region. 2% slop is recommended with broom finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Check concrete surfaces for spalling, depressions, cracking and surface irregularities.

B. Installers Examination:
   1. Installer to examine conditions under which construction activities are to be performed, and then submit written notification if such conditions are unacceptable.
   2. Transmit 1 copy of installers report to architect.
   3. Beginning construction activities of this Section indicates installers acceptance of conditions.

3.02 INSTALLATION

A. Install athletic recreational sports surface in accordance with shop drawings and manufacturer's written instructions.

3.03 PROTECTION

A. Protect installed products of this Section from damage to function or finish by subsequent construction activities.

B. Repair minor damage to finishes in accordance with manufacturer's recommendations.

3.04 DEFECTIVE WORK OR MATERIALS

A. Remove from the work site and replace material, which has deteriorated, or become contaminated in any way, prior to its application, at no additional expense to this contract. Dispose of waste materials legally, off site.

END OF SECTION

SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ornamental fences.
   2. Gates: single swing exit gates and double swing at Trash Enclosure gate.
   3. Hardware.
   4. Screens.
   5. Concrete Piers.
   6. Embed plates.

1.02 RELATED SECTIONS:

A. Section 00 31 00 - Available Project Information.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 20 00 - Concrete Reinforcement.

F. Section 03 30 00 - Cast in Place Concrete.

G. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

C. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

D. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

E. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

F. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ornamental fences, foundations and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated on Structural drawings.

B. Structural Performance: Ornamental fence, foundation and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE 7.
   1. Post Size: 4 inches (at pool fence and outdoor child activity fence), 3” (at patio seating area) and post spacing not to exceed 10 feet (3 m).
   2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on size and pattern specified and on the following:
      a. Wind Loads: Design wind pressures shall be based on Basic Wind Speed, Risk Category and Exposure Category indicated on Structural Drawings.
      b. Fence Height: Varies - Coordinate with Architectural Drawings.
      c. Material Group: Galvanized square steel.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for ornamental fences and gates.
   1. Fence and gate posts, rails, and fittings.
   2. Accessories: screen as indicated.
   3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: Prepared on Samples of size indicated below:
   1. Polyester power coated components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For ornamental fences and gate framework indicated to comply with performance requirements and design criteria, including calculations signed and sealed by the qualified professional engineer responsible for their preparation.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance. For the following to include in emergency, operation, and maintenance manuals:
   1. Polyester power coat finishes.
   2. Gate hardware.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates serving as a required means of access.

C. Pre-installation 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 gate operator.
   3. Review coordination of interlocked equipment specified in this Section and elsewhere.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for ornamental fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Approved Manufacturer:
   1. Iron World
      9390 Davis Ave.
      Howard County, MD 20723.
      Telephone 301-776-7448.
      Fax 301-776-7449.
      www.IronWorldFencing.com

B. Approved Product:
   1. Maverick Industrial Ornamental Picket Fence:
   2. Style: Canterbury – flat top picket.

3. Height: Per drawings.
4. Post Option: 4” square x 11 GA.
5. Picket Option: ¾” square x 18 GA.
6. Color: See drawings and spec section 09 91 00.

2.02 ORNAMENTAL PICKET FENCE

A. Pickets: Galvanized square steel tubular members manufactured per ASTM A653/A653M with a G90 zinc coating 0.90 oz/ft2 and steel to have 45,000 psi (310 Mpa) yield strength. Picket size shall be 3/4” 18 gauge wall thickness, and spaced at 3-1/2” face to face. Pickets shall be attached to rails using ¼” industrial drive rivets.

B. Rails: Horizontal U” channels shall be 1½” x 1 ⅜” x 1 ½” 11 gauge wall thickness (.072”) and galvanized: G90 zinc coating 0.90 oz/ft2. Manufactured per ASTM A653/A653M with a 50,000 psi (344 MPa) yield strength. Rails shall be mechanically punched to receive pickets and drive rivets. Attach rails to brackets using one-way security fastener.

C. Posts: Galvanized square steel tubular members manufactured per ASTM A653/A653M with a G90 zinc coating, 0.90 oz/ ft2. Steel to have 45,000 psi (310 MPa) yield strength. Post are coated with zinc on the inside and outside. Post size options 4” 11 gauge wall thickness.

D. Finish: All posts, caps and fence panels shall be polyester coated individually after fabrication to thoroughly coat all surfaces for additional corrosion protection. All components enter a 5 stage in line cleaning process to prepare the galvanized surfaces for complete adhesion of the finish coat. Components are given a TGIC polyester resin powder coating applied by the electrostatic spray process to 3.0 mil thickness. The finish is baked in an oven for 15 - 20 minutes at a temperature ranging from 400°F.

2.03 ACCESSORIES

A. Post Caps: Aluminum or formed steel manufactured to form a weather-tight closure. Caps shall be sloped style on each post.

B. Rail/Post Brackets: Standard 1½” x 1 ⅜” x 1½”, 11 gauge galvanized steel channels. Cover to be pressed to bracket for permanent installation. Bracket shall be fastened to post with one spray galvanized hex bolt. Rails shall be attached to bracket with one-way security fastener.

C. Pickets shall be secured to rails with ¼” aluminum industrial drive rivets to prevent movement. Rivets have a shear strength of 1,500# and a holding power of 1,100#.

D. Picket Tops: Flat top pickets with plugs.

E. Corrugated Metal Screening: Where indicated on drawings. 25 gauge steel min, conforming to the requirements of ASTM A653 and shall have a hot-dipped galvanized coating designation G-90, zinc coating (0.90 oz/ft²). Iron Curtain or eq.

2.04 SWING GATES

A. General Ornamental Metal Fence: Single swing at exit gates with metal screen on swing gate and at strike side of door to prevent entry from outside of enclosure. Refer to drawings for exact layout and door sizes.

B. Hardware: pressed steel, galvanized, and powder coated.
   1. Refer to section 08 71 00 for door hardware.
   2. Provide exit devices per drawings and section 08 71 00.

C. General Metal Trash Enclosure Doors: Double swing at Trash Enclosure gate types. Interlocking metal panels with vertical orientation at Trash Enclosure gate. Bolt/pin type door stop to be installed in door and concrete paving to secure door in closed position.

2.05 SETTING MATERIALS

A. Concrete: Minimum 28 day compressive strength of 2,500 psi.

B. Plated Post: Provide 1/2” steel base plates with 4 holes for surface mounting where indicated.

2.06 GROUT AND ANCHORING CEMENT

A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Project Manager.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install ornamental fencing to comply with ASTM F2408.
   1. Install fencing on established boundary lines inside property line.

B. Install fence per fence industry standards.

C. Set post uniformly at 8’-0” to 10’-0” on center unless otherwise indicated in drawings.

D. Set posts in concrete having a diameter 4 times the diameter of the post, and 6” deeper than the bottom of the post. Forms are not necessary or recommended.

E. Check each post for vertical and top alignment.

F. Attach panels to brackets using removable bolts.

3.04 ORNAMENTAL FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
      b. Concealed Concrete: Top as indicated on Drawings to allow covering with surface material.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach screening. 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.

3.06 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
   2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Project Manager promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
   3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.07 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of 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.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain ornamental fences and gates.

END OF SECTION

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SECTION 32 33 00
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bike Racks.

B. Shade Umbrellas.

C. Cabanas.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 03 30 00 - Cast In Place Concrete.

E. Section 26 56 00 - Exterior Lighting.

1.03 SUBMITTALS

A. Product Data: For each type of product included, provide construction details, material descriptions, dimensions of individual components and profiles, and finishes for bike racks.

B. Shop Drawings: For each type of product indicated:
   1. Shade Umbrellas.
   2. Cabanas.

C. Manufactures' Warranties.
   1. Bike Rack:
      a. Manufacturer's 2 year warranty.
   2. Shade Umbrellas:
      a. Manufacturer's 15 year Warranty for mast, structure and hardware.
      b. Manufacturer's 5 year Warranty for finishes, lift system.
   3. Cabanas:
      a. Manufacturer's 15 year Warranty for frame, roof and supports.
      b. Manufacturer's 5 year Warranty for finishes.

1.04 DELIVERY, STORAGE & HANDLING

A. Acceptance at Site: Ensure materials arrive at the site in unopened and undamaged containers. Packaging, Shipping, Handling and Unloading; Observe manufacturer’s recommendations and handle in a manner to prevent breakage.

B. Time delivery and installation of products to avoid extended on-site storage and to coordinate with work adjacent to installation locations.

C. Storage: Keep material from freezing, Store on pallets in a cool place; never in the hot sun.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify layout information shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements. Assure structural connections are properly located per plans and per manufacturer’s requirements.

PART 2 PRODUCTS

2.01 BIKE RACK

A. Available Manufacturer’s: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following
   1. Basis of Design: Huntco Supply, LLC. Portland, OR, (800-547-5909) model “BR Plus-X.”

B. Model: "Rambler Wide," Seven Bike Capacity.

C. Construction: 2-3/8” OD, 0.154 ASTM A53, Schedule 40 steel pipe, inverted “U” style, 36” to top of the inverted “U”, 18” clear between vertical members.

D. Mounting: In-ground (IG) mounting.

E. Finish: Innotek, Polyarmor G17, thermoplastic polyethylene copolymer-based powder coat.

F. Color: Tan “RAL1001.”

G. Post: Weldment comprised of 5” O.D. x 11 GA. (.120”) stainless steel tubing.

H. Finish: Powdercoat, color to be reviewed and approved by architect.

2.02 UMBRELLAS

A. Manufacturer: Tuuci.

B. UMB-1:
   1. Ocean Master MAX Single Cantilever – CL13 OCT
      a. Parasol Style and Shape: Market Profile – Octagon
      b. Parasol Size: 13’
      c. Parasol Type: Full Umbrella
      d. Top Canopy: Single panel color with edge binding – Fabric: Captain Navy
      e. Top Single Panel Fabric: To match canopy
      f. Frame Finish: Powder Coat – Espresso
      g. Lift System: Easy Drive Crank with wind stabilizer
      h. Final: MAX Accent Final
      i. Mast Height: 108” Open Position, 141" Closed Position
      j. Mounting: Through paver, concrete-set, in-ground security mount, confirm finishing plates with architect and manufacturer.

2.03 CABANAS

A. Manufacturer: Tuuci
   1. Model: Solanox

B. CABN-1:
   1. Frame:
      a. Dimensions: 10’ x 12’
      b. Finish: Powder Coat - Espresso
   2. Roof:
      a. Type: Trellis with soft shade fabric solar screen
      b. Horizontal member finish: Powder Coat - Espresso
      c. Fabric Color: Twitchell Desert Tan
   3. 12’ Back Wall 1:
      a. Type: Trellis
      b. Finish: Powder Coat - Espresso
   4. 10’ Side Wall 2: Full curtains in Sunbrella Canvas Flax #5492.
   5. 12’ Front Wall 3: NO WALL.
   6. 10’ Side Wall 4: Full curtains in Sunbrella Canvas Flax #5492.
   7. Electrical: Outlet & USB included in each cabana, coordinate with electrical for power connection points. Standard outlet and USB location.
   8. Mounting: through-paver, concrete-set security mount IGSM with leveling stainless steel base plate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with manufacturers requirements before installation; reject any product with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install bike rack to comply with manufacturer's written instructions, referenced standards and as indicated.

B. Transport, Install; and Clean Umbrellas to comply with manufacturer's written instructions, referenced standards and as indicated.

C. Transport; Install, and Clean Cabanas to comply with manufacturer's written instructions, referenced standards and as indicated.

1. Coordinate lighting and technology features with Electrical and Technology Contractors, drawings and specifications.

3.03 PROTECTION

A. Protect surfaces, edges, and corners from construction damage.

B. Before inspection for Substantial Completion, remove protective coverings and clean surfaces.

3.04 WARRANTY

A. Closeout Submittals: Provide manufacturer's completed warranty form and submit to client.

END OF SECTION

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SECTION 32 35 00
SCREENING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative Exterior Ceramic Screening.

1.02 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 04 20 00 - Unit Masonry.

F. Section 05 50 00 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Submit product data and certification of products to include:
   1. Ceramic Components.
   2. Anchors.
   3. Mortar.
   4. Reinforcement.

C. Shop drawings:
   1. Ceramic unit layout.
   2. Reinforcement.
   3. Frame.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Fabricator Qualifications: Company specializing in fabricating products specified in this section, with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package units and protect them from staining or damage during shipping and storage.

B. Provide an itemized list of product to support the bill of lading.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Installer Warranty: Provide 2-year warranty commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 CERAMIC UNITS

A. Manufacturer:
   1. WOW USA, Inc.
      9408 Gunston Cove Rd. Unit C-D
      Lorton VA 22079 United States
      (703) 910-6162

B. Materials:
   1. ICON Series INOUT Sand
   2. Substitutions: Not Permitted.
   3. Dimensions: 4" x 8" x 3"
   4. Installation Pattern: See Drawings.

2.02 METAL FRAMES

A. See Section 05 50 00 - Metal Fabrications and Structural Drawings.

2.03 MASONRY ANCHORS

A. See Section 04 20 00.

B. Adjustable “Mechanical” Anchors for Connecting to Cold-Formed Steel Framing: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall as recommended by Ceramic Unit Manufacturer.
   1. Hohmann and Banard: HB-213 Adjustable Anchors.
   2. Or equal.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: truss type with single pair of side rods.
   1. Products: Subject to compliance with requirements. Provide one of the following: Single Wythe Joint Reinforcement: Truss type; hot dipped galvanized to comply with ASTM A153/A153M, Class B2 coating; 9 gage side rods and cross ties. Provide preformed corners and tees.
      a. Hohman and Barnard, Inc., Lox-All No. 125 Truss-Mesh.
      b. Dur O Wal, Inc., Dur O Wal Truss.
      c. Wire Products, Blok Trus AA600.
      d. Masonry Reinforcing Corporation of America, Series 300, Single Wythe Truss Type.
      e. Or approved equal.

2.04 MORTAR

A. See Section 04 20 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that all substrates have been installed according to requirements.

B. Notify Architect in the event of unsatisfactory conditions.

C. Commencement of work indicates acceptance of conditions.

3.02 INSTALLATION: STEEL FRAME

A. See Section 05 50 00 - Metal Fabrications and Structural Drawings.

B. Field Painting:
   1. Install Masonry anchors prior to field painting of frame.
   2. Field paint frame as indicated on drawings.
   3. Protect exposed surfaces of frame during Ceramic unit installation.

3.03 INSTALLATION: CERAMIC UNITS

A. Install in accordance with manufacturer's written instructions.

B. Avoid cutting units: use manufacturer's full and half units as indicated on drawings.

C. Provide Expansion joints for areas of screen wall longer than 12'-0".

D. Paint Units as indicated.

3.04 PROTECTION

A. Protect installed materials from subsequent construction operations.

END OF SECTION

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SECTION 32 35 15
LANDSCAPE SHADE TOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Landscape shade tops.

1.02 RELATED SECTIONS:

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Division 3 Section Cast-in-Place Concrete for cast-in-place concrete post footings.

1.03 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for Landscape Shade Tops.
   1. Landscape Shade Top fabric, posts, and fittings.
   2. Accessories: None.

B. Material and Color Samples: For pre-finished structural members and shade canopy fabric.

C. Product Certificates: For each type of Landscape Shade Structure, from manufacturer.

D. Product Test Reports:
   1. Framing strength according to ASTM F2408.
   2. Non-Combustible per NFPA 701B.

E. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

F. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance. For the following to include in emergency, operation, and maintenance manuals:
   1. Assembly.
   2. Polyester power coat finishes.

G. Warranty: Sample of special warranty.

1.05 DELIVERY, STORAGE & HANDLING

A. Acceptance at Site: Ensure materials arrive at the site in unopened and undamaged containers.

B. Storage: Keep material from freezing, store on pallets in a cool place; never in the hot sun.

C. Deliver landscape shade tops cardboard-wrapped or crated to provide protection during transit and job storage.

D. Inspect landscape shade tops on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to the Architect; otherwise, remove and replace damaged items as directed.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for Landscape Shade Tops shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following
   1. Landscape Structures, Inc.; “CoolToppers” Single Post Shade.
   2. USA Shade and Fabric Structures; Single Post Pyramid Unit.
   3. Or approved substitution.

2.02 CONSTRUCTION

A. Shade Top: High-density polyethylene with ultra-violet additives. All corners to be strengthened with 16 oz. non-tear vinyl material. Protective webbing is sewn into all areas where steel cable enters/exits cloth pockets. Live loads 20.00 psf. Wind design speed to withstand 80 mph. Uplift 18.75 psf. Snow Loads 5.00 psf. Tear strength warp 220.46 lb. and wet 462.97 lb. Burst strength 37.70 PSIA.
   1. Color: Tan. (Desert Sand)
   2. Color at Diamond Pool Reception: Denim. (Navy Blue)

B. Roof Sleeve: Cast from 319 almag.

C. Disc: 1” thick x 10” diameter white high density UV stabilized polyethylene.

D. Extension Arms: Weldment comprised of 2.375” O.D. RS-20 (.095”-.105”) galvanized steel tubing and 5/16” HRPO gusset. Finish: Powdercoat, color: Tan.

E. Post: Weldment comprised of 5” O.D. x 11 GA. (.120”) stainless steel tubing. Finish: Powdercoat, color: Tan.

F. Size: 12 ft by 12 ft.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for landscape shade tops before installation; reject any landscape shade tops with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install landscape shade tops to comply with manufacturer’s written instructions, referenced standards and as indicated.

END OF SECTION

SECTION 32 35 16
OUTDOOR SHADE STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Outdoor Awning Shade Structure.

1.02 RELATED SECTIONS:

A. Section 01 33 00 - Submittal Procedures.

B. Section 01 40 00 - Quality Requirements.

C. Section 01 60 00 - Product Requirements.

D. Section 01 92 00 - Facility Operation and Maintenance.

E. Section 03 30 00 - Cast-in-Place Concrete for cast-in-place concrete post footings.

F. Section 32 31 13 - Tennis/Pickleball Fences Gates and Windscreens, for connections to Tennis/Pickleball Fence.

1.03 DESCRIPTION

A. Work Included: Furnish and install the outdoor shade structures as indicated on the drawings, specified herein, and as necessary for proper completion including, but not necessarily limited to:
   1. Shade fabric top material.
   2. Tension cable and related hardware.
   3. Structural steel support system.
   4. Concrete foundations.
   5. Concrete reinforcement.
   6. Fire resistance.
   7. Fire protection.
   8. Lighting.
   9. Installation supervision.
   10. Labor, material and equipment to complete the installation.
   11. Operations and maintenance manuals.
   12. On site training.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design:
   1. Design 100 percent of Awning shade structure, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
      a. Design Awning shade structures under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the state/province of the project.

B. Design Trellis shade system and cable supports to be attached to the structure provided.
   1. Design Trellis shade structures under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the state/province of the project.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for Outdoor shade structure.
   1. Outdoor shade structure fabric, posts, and fittings.
   2. Accessories.

B. Samples for Verification:
   1. Shade fabric.
   2. Steel colors.

C. Shop Drawings:
   1. Shade Structure Canopy Design:
      a. Shade structure canopy design shall be completed and constructed by the shade structure manufacturer.
      b. Shade structure canopy design, as it relates to connecting to the existing building, shall be coordinated with the Engineer of Record.
   2. Concrete Foundation Design:
      a. Concrete foundation design shall be completed by the shade structure manufacturer and constructed by the general contractor.
   3. Anchor bolts for the shade structure foundations shall be hot dip galvanized and supplied by the shade structure manufacturer.
   4. The shade structure structural steel supports shall be installed by the shade structure manufacturer under the direct supervision of the manufacturer's representative.
   5. Design Submittal: The Contractor shall submit three sets of detailed design calculations and final plans, elevations, and details of the shade structure(s). All calculations and drawings shall be prepared and sealed by a professional Structural Engineer (P.E.) –experienced in shade structure design and licensed in the state where the structure is to be built.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: Submit O&M manuals according to the requirements of Section 01 92 00 - Facility Operation and Maintenance. For the following to include in emergency, operation, and maintenance manuals:
   1. Assembly.
   2. Polyester powder coat finishes.

F. Warranty: Sample of special warranty.

1.06 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Codes and Standards:
   1. In addition to complying with all applicable codes and regulations, comply with pertinent recommendations contained in the following:
      a. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

C. Manufacturer's Qualifications: Company specializing in manufacturing products specified in this section with not less than three (3) years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this Section with a minimum of three (3) years of experience.

E. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE & HANDLING

A. Acceptance at Site: Ensure materials arrive at the site in unopened and undamaged containers.

B. Storage: Keep material from freezing, store on pallets in a cool place.

C. Deliver outdoor shade structure cardboard-wrapped or crated to provide protection during transit and job storage.

D. Inspect outdoor shade structure on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to the Architect; otherwise, remove and replace damaged items as directed.

1.08 WARRANTY

A. All work of this Section shall be warranted against all defects of material and/or application for a period of one (1) year from the date of acceptance. The shade structure's fabric top material shall be warranted for six (6) years against failure from significant deterioration. Any failures that may occur within this warranty period, due to defective installation and/or materials, shall up written notification of such failure be immediately repaired or replaced.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for shade structure as shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. USA Shade and Fabric Structures.

2.02 TYPES

A. "Awning" Shade Structure.
   1. Shade Fabric Top Material:
      a. Raw Material: High-density fire-retardant polyethylene with ultra-violet additives.
      b. Construction: Monofilament and tape construction giving a stable material to ensure material will not unravel if cut.
      c. Sewing Specifications:
         1) Strengthened with 16 oz. Non-tear vinyl material.
         2) Protective Webbing: Sewn into all areas where steel cable enters/exits cloth pockets.
   2. Tension Cable & Related Hardware:
      a. General: All hardware to be first grade stainless steel. All bolt fittings include nylon washers for watertight seals at all joints.
      b. Bolts: All erection bolts are ASTM A307, Grade B, treated to retard corrosion, or stainless steel.
      c. Wire Rope: ¼" nominal diameter, 7 strand, 19 wires per strand (minimum), with a minimum nominal tensile strength of 9,000 pounds. Wire rope shall be secured with approved fittings and cable hardware, as per manufacturer's specifications.
   3. Structural Steel Support System:
      a. Where size of structure or determined loads requires larger structural steel members or steel greater than 7-gauge thickness, carbon steel may be substituted. Cleaning and coating of carbon steel conforms to the following:
         1) A de-greasing agent is applied to remove surface oil and grease.
         2) An acid-phosphate wash is applied to etch and prepare the surface for powder-coating, where wall thickness requires preheating.
         3) Steel members are preheated prior to powder coat application to assure adhesion.
      b. All carbon Structural Steel shall be ASTM A36, except steel pipe columns, which shall be ASTM A53, Grade B, unless otherwise noted. Slip fittings are manufactured using drawn-over-mandrel steel with minimum yield strength of70 ksi and a minimum tensile strength of 80 ksi.
      c. Steel telescoped sleeves do not have more than 1/16" tolerance, with no less than 4" overlap at all sleeves. All internal fittings are welded on one side.
      d. Structural steel is detailed, fabricated, and erected in accordance with AISC specifications.
      e. Shop connections are welded unless noted otherwise. Field connections are separately indicated on the shop drawings.
      f. All welds are performed using E70 electrodes or gas-metal arc welding using ER 7053 wire. All fillet welds are a minimum 3/16" unless otherwise noted. All steel shall be welded shut at terminations to prevent internal leakage.

g. All structural steel plates are rust/corrosion treated by zinc electroplating. Steel tubing and plates are finished with a minimum of 2.5 to 3.5 mil thick UV-inhibited weather resistant powder coat.

B. Accessories to outdoor shade structures:
   1. Ceiling fans.
   2. See Electrical drawings and Specifications.
      a. See Architectural drawings for size and location.
      b. Coordinate mounting, wiring and controls with Shade Structure provider and electrical.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for shade structures before installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FABRICATION

A. Fabricate all shade structures in strict accordance with the approved Shop Drawings and referenced standards.

3.03 INSTALLATION OF FOOTINGS & FOUNDATIONS

A. Foundations shall be installed in strict accordance with the Shop Drawings. All supplies, labor and installation will be furnished by others and not the responsibility of the shade structure manufacturer. Install in accordance with the manufacturer’s structural drawings and instructions.

B. If AHJ requires Special Inspections of footings, coordinate special inspections with owner and Spec Section 01 45 33.

3.04 ERECTION

A. Erect all shade structures in strict accordance with the shop drawings and all pertinent regulations and standards.

3.05 CLEAN-UP

A. Upon completion of the work of this section, immediately remove all debris and rubbish occasioned by this work.

3.06 OWNER INSTRUCTION

A. Manufacturer shall train Life Time personnel in the operation, maintenance, required removal, etc., of the shade structures at the job site during start-up.

END OF SECTION

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 GENERAL

1.01 SUMMARY

A. Scope of work: Furnish and install the complete underground irrigation system specified herein including: enclosure, meter, backflow prevention and Irrigation controller throughout site; including labor, materials, equipment, apparatus, and services for the testing, adjusting, retesting and readjusting as required to place the system in an approved operating condition.

B. Unless otherwise specified, the plans and specifications are intended to include everything obviously requisite and necessary for the proper installation and completion of the work whether each necessary item is mentioned herein or not.

C. The plans and specifications are intended to be cooperative and any item called for in one and not the other shall be as binding as if called for in both.

D. Any Contractor field alterations to the plan, details, or specifications will not be approved by the Facility Manager and/or Landscape Architect. Submittals for substitutions must be submitted 14 days prior to bid for consideration.
   1. The irrigation systems shall include the following:
      a. Source Location – from 4” water line (By Others), meter, backflow (meter and backflow to be installed on “flange” fitting for ease of removal). Contractor to verify location (approximate locations shown in design documents), quality and available flow characteristics as listed in design documents. Contractor to inform Facility Manager’s Representative of any perceived issues with source location.
      b. Control System:
         1) As approved by LT Operations.
         2) Cellular Modem - to be installed by a qualified Contractor.
         3) Soil Moisture Sensors
         4) Flow Sensor
         5) Pressure Sensor Kit
         6) Lightning Arrestor, with grounding as required.
      c. Piping.
      d. Sprinkler heads.
      e. Valves and Valve boxes.
      f. Control wiring & Grounding.
      g. Fittings.
      h. Electrical connections.
      i. Quick-couplers.
      j. All other necessary accessories.
      k. System Manuals.
      l. Instructional walk-through with Facility Manager.

E. Limits of work: Area within project limits as delineated on the irrigation plan.

F. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
   1. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

B. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

C. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
   1. Finish Grade: Elevation of finished surface of planting soil.

G. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
   1. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), mammals (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. Plant, Plants, Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
   1. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
   1. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

N. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.03 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Irrigation contractor must be able to provide “Verifiable Documentation” that they have the technical qualifications, experience, trained personnel and facilities to perform the specified work, including experience with Irrigation control system to be installed and have been engaged in sprinkler design and installation, of systems of similar size and scope for a minimum of five years. Contractor must

submit, along with bid, a list of five projects/contacts of similar scope completed within the last three years.

C. Quality Control Criteria:
   1. Provide irrigation products as described in this specification and according to manufacturer's specifications.
   2. Contractor shall have, on site at all times during construction, a designated individual who is qualified by the irrigation system manufacturer. No work shall be done on site when the authorized individual is not on site.
   3. Comply with requirements of the State of installation for prevention of backflow and back-siphonage.
   4. Comply with requirements of the State of installation for plumbing and other regulations affecting site irrigation.
   5. Comply with National Plumbing Code, National Electric Code, and all other applicable city or state codes.

1.04 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Submit manufacturer's literature, technical data, and recommendations for the system as specified including:
   a. Certificate from Irrigation System Manufacturer that Installer is qualified to install the system.
   b. Pipe.
   c. Fittings.
   d. Valves.
   e. Controller/Flow Sensor.
   f. Backflow preventer.
   g. Wiring & Grounding.
   h. Valve boxes.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Closeout Submittals – Submit the following:
   1. As-built drawings: Following construction of system, submit two (2) reproducible hard line sets of as-built drawings and an electronic copy (BIM or AutoCAD release 2018 or newer).
   2. Irrigation controller complete setup including but not limited to;
      a. Programs for turf, landscape and annuals.
      b. Flows learned and verified for each zone.
      c. Moisture Sensors setup and verified.
      d. Pressure Sensor setup and verified.
      e. Zone Information including – type, decoder information and location descriptions.
      f. Grounding/Lightening Arrestors locations and field readings at all locations.

E. Submit color-coded As-Built drawing of controller chart including zone descriptions, locations, decoder serial numbers and suggested run times.

1.05 JOB CONDITIONS

A. Contractor shall carefully examine the work site, local conditions, specifications and plot plan for any existing conditions and limitations that may apply to the work. Submission of a proposal shall be considered evidence than an examination has been conducted and that any questions and/or concerns have been satisfied.

B. Utilities: Determine location of utilities and perform work in a manner which will avoid possible damage. When necessary the Contractor shall make any minor adjustments in location or alignment of the new work. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned. Contact Facility Manager if potential conflicts are apparent.

1.06 SEQUENCING AND SCHEDULING

A. Schedule and coordinate to facilitate the most expeditious completion of the project in a workmanlike manner.

B. Consult all other relevant specification sections to determine the extent of work specified elsewhere but related to that included herein.

C. Schedule and coordinate all required irrigation utility connections with other project trades and/or utility companies.

D. Obtain information pertaining to location of all proposed lines and accessories prior to irrigation installation.

E. Contractor shall assume responsibility for locating all site utilities and perform work in a manner to avoid damage.

1.07 PROTECTION OF EXISTING CONDITIONS

A. Any existing structures, equipment, utilities, pavement, landscaping, etc., damaged by Contractor during the course of the work including any subsequent damage caused by leakage or settling of piping shall be restored at Contractor's expense.

1.08 HANDLING

A. Deliver irrigation system components in manufacturer’s original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packed to provide adequate protection of pipe ends, both threaded and plain. Pipe and accessories shall be handled in such manner as to ensure delivery to the trench in sound, undamaged condition. Before installation, the pipe shall be inspected for defects. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced to prevent installation delays.

E. Manufacturer’s Specifications: The latest printed specifications of approved manufacturer of materials shall become part of these specifications.

1.09 EXTRA MATERIALS

A. Provide extra materials as follows:
   1. Six extra sprinkler heads of each type and size.
   2. Two valve keys for manual valves.
   3. Two Quick-Coupler Keys with hose swivels.
   4. Six wrenches for each type head core and removing and installing each type head.

PART 2 PRODUCTS

2.01 MAIN LINE

A. Piping on pressure side of irrigation control valves:
   1. Polyvinyl chloride (PVC) 1120-1220, SDR 21 Class 200, and conform to ASTM standards D2241-05 & D2672 or latest revision. Materials shall conform to all requirements of D1784, or latest revision.
   2. Main line size 4” and above shall be gasket type pipe & fittings. Gasket fittings can be either ductile iron or PVC gasket fittings with joint restraints.

2.02 LATERALS

A. Piping on non-pressure side of irrigation control valves:
   1. Polyvinyl chloride (PVC) 1120-1220, SDR 26 Class 160, and conform to ASTM standards D2241-05 & D2672 or latest revision. Materials shall conform to all requirements of D1784, or latest revision.
   2. Pipe 1-1/4" and smaller pipe may also be flexible non-toxic polyethylene pipe made for 100% virgin material meeting N.S.F. (National Sanitation Foundation) standard #14 for use in pressure potable water applications, for 800 design stress. All sizes shall have a minimum 100 P.S.I. working pressure rating. All polyethylene pipes shall be continuously and permanently marked with the manufacturer's name, material, size, and schedule. Pipe shall conform to A.S.T.M., D2239, and D1248 (3C5PE34) or latest revision.

2.03 FITTINGS

A. Solvent welded socket fittings conforming to ASTM D2467 (Schedule 80 PVC) and ASTM D2466 (Schedule 40 PVC). Threaded type fittings shall conform to ASTM D2464 (Schedule 80 PVC). Solvent cement shall conform to ASTM D2564. Swing Joints for all rotary/gear driven sprinkler heads shall be minimum schedule 40, as manufactured by Dura or approved equal. Burst strength of fittings shall equal or exceed that of the pipe on which they are installed.

2.04 SPRINKLER HEADS

A. Sprinkler heads shall be installed as shown in design documents.

B. Gear Driven Rotary Heads: Hunter I-20, nozzle and arc as shown on design documents. Sprinkler case shall be of heavy-duty plastic construction rubber cover, Water lubricated gear drive, extra strong spring and Drain check valve for up to 10’ of elevation change. Match the precipitation rates between full circle and part circle heads when valved together in the same zone.

C. Pop-Up Spray Heads: Hunter PRS30-04-CV & MP-PRS40-04-CV in Turf & Hunter PRS30- 12-CV, MP-PRS40-12-CV in Plantings. Matched Precipitation Nozzles - arcs as shown on design documents. Sprinkler case shall be of heavy-duty plastic construction with plastic or rubber cover, extra strong spring. Match the precipitation rates between full circle and part circle heads when valved together in the same zone. Nozzles shall be interchangeable.

D. Adjustable nozzles are acceptable only in “odd” angle applications.

2.05 CONTROL VALVES

A. Remote control valves shall be Hunter ICV Series. Valves shall have Heavy-duty solenoid, High grade construction, and Manual bleed, Flow control with non-rising handle, rigid diaphragm support, Single piece diaphragm, Globe and angle configurations, Captive bonnet bolts and solenoid plunger.

2.06 CONTROLLER

A. Control system: Provide control system with the following features, compliant with local water-use regulation, and acceptable to LT Operations.
   1. Controller shall have an outdoor painted aluminum or stainless steel wall mount controller.
   2. Cell Modem.
   3. Water Management Functions:
      a. Moisture Sensors – located in design documents.
      b. Pressure Sensor – located in design documents.
      c. Rain Sensors--located in design documents.
      d. On-Site Rain/Freeze Switch.

B. Mount the controller in such a way as to simplify the programming/visibility of the controller (see detail). Contractor to ensure controllers and wire path are grounded to 10 OHM or less. Verify the exact location with the Facility Manager and/or Landscape Architect while still adhering to the manufacturer’s recommendations.

2.07 QUICK-COUPLING VALVES

A. Provide quick coupling valves as shown in design documents.

B. Provide six (6) valve keys fitted with 3/4" swivel hose cells.

C. Quick Coupling Equipment:
   1. Valves: One-piece body constructed from heavy-duty cast bronze with a 1" FIP riser connection.
   2. Quick Couplers: Single lug coupler of heavy cast bronze and detachable handle.
   3. Swivel Hose ELL: Heavy cast bronze, connected to quick couplers for hose connection.
      a. 1" FIPX 1" Male Hose Threads.
      b. Or approved equal.
   4. Each quick coupler should be installed in a valve box by Carson (or approved equal) and packed with pea gravel, 4" in depth.

2.08 VALVE BOXES

A. Provide box and cover, with open bottom and openings for piping; designed for installing flush with grade. Include size as required for valves and service. The box shall be of plastic construction with UV protection. Boxes shall be vandal resistant including lockable lid. Permanently label valve box cover with zone number. Box and lid assembly color shall be green color.

B. All valves shall be installed in 12” rectangular valve box – 1 valve per valve box.

C. All drip valve assemblies shall be contained in 12” minimum rectangular box, one valve per valve box.

D. Accepted manufacturers: Carson.

E. Decoders shall be secured to lip of valve box.

F. All valve boxes shall be permanently labeled with brass/stainless tag indicating zone number and/or equipment enclosed.

2.09 CONTROL WIRE

A. Electrical control wires shall be a jacketed, minimum of #14 gauge wire - #12 gauge on any run over 2000 feet. Run an additional two-wire path consisting of a jacketed and twisted pair of #14 gauge wire, as manufactured by Paige. Two-wire path shall be stubbed in to all valves in the system.

B. Provide separate wire path, different color, for each controller.

C. The wire path shall be grounded, to 10 ohm or less, and at a maximum of 500 foot intervals. Grounding shall also be installed on the end of all cable runs.

D. Future wire jackets, if specified, shall be a different color than initial “field” wires.

E. Provide a minimum of 3’ loop for ease of connection at valves and six to ten feet extra at controller location.

2.10 BACKFLOW PREVENTER

A. Provide Vacuum Breaker only if allowed by code and local ordinance.

B. Product:
   1. Febco Vacuum Breaker or Febco RPZ.
   2. Or approved equal.

C. Backflow preventer shall be contained in separate enclosure.

2.11 RAIN/FREEZE SENSOR

A. Sensor shall be capable of rain/freeze shut off. The device shall be mounted in a location unobstructed by walls, trees, or other hindrances (as not to be vandalized). Coordinate final field placement with Facility Manager’s Representative.

2.12 MANUAL VALVES

A. Manual valves shall be bronze gate type. Manual valves shall be sized according to the line size they are being installed on.

B. Manual valve location(s) - refer to plan.

C. Manual valves shall be “push-on” type with joint restraints 3” and larger.

2.13 REMOTE CONTROL

A. Provide remote control and monitoring of the irrigation system. Contractor to verify operation over the entire site and make any adjustments necessary to ensure uninterrupted coverage of site.

2.14 DRIP IRRIGATION

A. Drip pipe and all components are to be specifically manufactured for underground drip irrigation by Rain Bird.

B. Drip control valves shall have basket type, pressure regulating filter assembly, with visible gauge on top of basket.

C. System is to be self-cleaning, pressure compensating and UV resistant. Drip line shall be buried a minimum of 4” and a maximum of 6” deep in planting soil. Staple drip lines a minimum of every four feet and at every change in direction.

D. All “headers” for drip line shall be PVC – minimum 1” or manufactured header pipe such as Rain Bird QF Dripline Header.

E. At least one shut-off valve, flush valve, operation indicator to be installed in each drip irrigation bed.

F. Drip valve assemblies shall be placed in a 12” rectangular valve box – one valve per valve box.

PART 3 EXECUTION

3.01 PERMITS, LICENSES AND CERTIFICATES

A. The Contractor shall procure all permits and licenses, except as otherwise indicated, pay all charges and fees and give all notices necessary and incident to the proper and lawful prosecution of the work.

B. He shall also obtain and supply the Facility Manager all certificates required to show that the work has been performed in accordance with the building, plumbing, other authorities, the Board of Fire Underwriter's, or such other like bodies, as the specifications may require directly or by implication.

C. When the work performed affects the property of facilities of public utility or other corporations or of private persons, he shall obtain and supply from such corporations or person if required, statements that the work has been performed satisfactorily so far as their interests are affected and that all claims therefore have been settled by the Contractor.

3.02 RIGHTS OF WAY

A. The Contractor shall acquire the necessary right of way or lawful authority that may be necessary for approved crossings or occupation of any roads, street or alleys upon which the contract work will be done.

3.03 UNDERGROUND STRUCTURE

A. The Contractor shall be responsible for all necessary information regarding the exact location of existing underground structures and utilities and shall mark their location, at the site.

B. The Contractor shall be liable for the damages to and the cost of repairing or replacing any buried conduit, cables or piping encountered during the installation of the work, unless they were not marked or the Contractor was not previously informed of such underground utilities. If the Contractor is aware of such utilities, he shall immediately have the incurred damages repaired at his own expense. Conversely, the Facility Manager shall be liable for the cost of repairing to any of those existing utilities of which the Contractor had not been previously informed.

3.04 EXCAVATING AND TRENCHING

A. Perform excavations as required for installation of work. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.

B. Dig trenches wide enough to allow a minimum 6" between parallel pipelines. Trench sufficient depth to provide minimum cover (18” for all main lines and 12” for all laterals) as measured from finish grade as shown on drawings.

3.05 SLEEVING

A. Install PVC, see plan for type, sleeves where any control wire and/or pipe pass through or under walls.

B. Install PVC, see plan for type, sleeves for control wiring and pipe under walks and paving.

C. Main line shall be placed in PVC, see plan for type, sleeving that is a minimum of two sizes larger than pipe contained. Lateral line sleeving shall be a minimum of two pipe sizes larger than pipe contained.

D. Sleeves to be provided and extend a minimum of 12" beyond edges of walls, walks, and paving.

E. Mark the sleeve ends with an iron post.

F. Place wires in separate sleeve (1 ½" minimum).

G. Coordinate sleeve installation with other trades as required.

3.06 PIPE INSTALLATION

A. Install pipe in accordance with manufacturer's instructions.
   1. Solvent-weld PVC pipe and fittings, using primer, solvents, and methods recommended by manufacturer, except where screw connections are required. Clean pipe and fittings of dirt and moisture before assembly. Snake pipe from side to side of trench bottom to allow for expansion and contraction. Make all connections between PVC pipe and metal valves or pipe with threaded fittings using PVC male adapters.
   2. Use Teflon tape only on threaded joints, plastic to plastic and/or plastic to metal. Assemble threaded PVC fittings finger-tight plus one to two turns - no more.

B. Install thrust blocks on main lines (larger than 3") at locations that make a change of direction.

C. Avoid following piping layout situations:
   1. Avoid piping layout along sides of structures.
   2. Avoid odd angles in piping layout.
   3. Avoid unbalanced friction losses.
   4. Avoid high friction losses.
   5. Avoid excessive trenching.

3.07 SPRINKLER HEADS

A. Location of Sprinkler Heads: Sprinkler heads adjacent to back-of-curbs shall be located 6" off of curb edge and ½" below top of cub to prevent damage to head. Contractor is responsible for 100% radius (head-to-head) overlap coverage. When possible, locate sprinkler heads so that trees are approximately halfway between heads. Sprinkler heads and quick coupling valves shall be installed perpendicular to grade and level with terrain, unless otherwise indicated. Do not spray buildings or sidewalks.

B. All risers to heads shall be constructed to permit height adjustment of head.

C. Adjustable nozzles are acceptable only in "odd angle" situations. Fixed arc nozzles are required on all other heads.

3.08 ZONE VALVES

A. Remote Control Valves: Install control valves in valve boxes where shown and group together where practical. Place no closer than 12" to walk edges, buildings, and walls. Set valve boxes flush with finish grade.

B. Male adapters are NOT permissible – Utilize toe nipples when installing valves or equipment with threaded fittings.

C. Drip valve assemblies shall be placed in a 12" rectangular valve box – one valve per valve box.

3.09 CONTROLLERS

A. Install per local code and manufacturer's instructions.

B. Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.

C. Affix a non-fading copy of irrigation diagram to cabinet door. Irrigation diagram is to be sealed between two sheets of 20mm laminate. Irrigation diagram shall be a copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size, and type of turf/planting irrigated.

D. Exact field location of controllers to be verified before installation. Coordinate the electrical service to these locations.

3.10 CONTROL WIRING

A. Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lie to the side of pipeline and tie wires in bundles at 10' intervals and allow slack for contraction between ties.

B. Provide a minimum of 3' of looped extra ground and control wire at each valve and at 200' intervals on long wire runs. Snake wires in trench to allow for contraction of wires.

C. Control wire splices at remote control valves to be sealed with a Direct Burial Splice Kit - 3M DBY-6/DBR-6. Ensure that splice sealant completely blocks path to wire nut inside of spice.

3.11 VALVE BOXES

A. All valve boxes shall be supported in the ground by using paver style bricks in every corner or side.

B. See valve box detail on plan for installation directions.

C. Provide sufficient clearance (minimum 4”) between valve box cover and the automatic valve, to prevent damage if the valve box is driven over.

D. Wood supports of any kind are not allowed.

E. All valve boxes shall be permanently labeled with brass/stainless tag indicating zone number and/or equipment enclosed.

3.12 IMPROPERLY OPERATING OR LOCATED EQUIPMENT

A. Any equipment which fails to operate properly and/or is located incorrectly shall be promptly corrected or relocated at the Contractor's expense. If the Contractor wishes to make any field changes, he must receive written permission from both the Facility Manager and Landscape Architect.

3.13 THRUST BLOCKS

A. Provide thrust blocks at all changes in size or direction of mainline piping (3” and larger unless otherwise specified). Elbows, reducers, plugs, and the opposite side of tee branches all require thrust blocks. Concrete thrust blocks are constructed by pouring concrete between the fitting and the undisturbed bearing wall of the trench.

3.14 FLUSHING AND TESTING

A. 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.

B. Thoroughly flush out all water lines before installing heads, valves, and other hydrants.

C. Testing: All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor. Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 100 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Facility Manager.

D. Upon satisfactory completion of testing, complete assembly and adjust all heads for proper arc and radius.

3.15 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of rubbish.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95% density under pavements, 85% under planted areas.

C. Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.

D. Dress off all areas to finish grade.

3.16 CLEANUP

A. Keep areas of work clean, neat, and orderly at all times. Keep paved areas clean during installation. Clean up and remove debris from the entire work areas prior to final acceptance.

B. Protect irrigation system and materials from damage due to performance of work, operations by other contractors, trades and trespassers. Maintain protection during installation and testing period.

C. The Contractor shall be responsible for all damage caused by his operations to trees, turf, shrubs, curbs, paving, structures, utilities, etc., on the site or adjacent to the site of the work and shall repair, replace or otherwise make good any damage caused by their work.

3.17 WINTERIZATION AND SPRING START-UP OF IRRIGATION SYSTEM

A. The contractor shall prepare the entire irrigation system for one winter by removing all water within the mainline and lateral piping. Water shall be diverted so as not erode existing landscaping or final grades. If damage does occur, the contractor shall make repairs to the Facility Manager’s satisfaction at no additional cost.

B. The contractor shall provide one Spring Start-up of the entire irrigation system by filling the mainline and lateral piping with water and operate all control valves with the automatic controller. The contractor shall also set the controller timing for spring irrigation.

C. During Wintering and Spring Start-up the contractor shall contact the Facility Manager and current landscape maintenance provider responsible for the project site and educate them to the operations of the system. Also, the contractor shall provide a written copy to the Facility Manager of the irrigation timing required for establishing plants during late spring, summer and fall schedules.

D. The contractor shall coordinate and assemble a written instruction manual that indicates step by step the winterizing and start-up operations. The instructions shall be included in the O & M manuals.

PART 4 ACCEPTANCE

4.01 ACCEPTANCE

A. Demonstrate operation of all irrigation zones for the Facility Manager and/or Landscape Architect, a current As-Built is to be provided to the Facility Manager/Landscape Architect for purposes of the walk-thru. All irrigated areas are to have 100% coverage. Contractor shall add additional heads, as necessary, at no cost to the Facility Manager. Adjust all heads as required for proper operation, alignment, elevation, radius, and arc.

B. A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of up to 16 hours of normal working time and shall start after the central control system, weather station and field components of the irrigation system are functionally complete and major adjustments to controller, due to establishment of materials, is substantially complete. Field training shall cover all the items contained in the operating and maintenance manuals.

C. The Contractor will provide on-site consultation with the Facility Manager's operating personnel for a period of 6 months, not to exceed 8 hours per month, at no cost to the Facility Manager. This consultation will be provided at the Facility Manager's request.

D. All future visits required by the Irrigation Landscape Architect, after initial punch list, will be charged to the irrigation contractor.

4.02 GUARANTEE

A. The entire sprinkler system will be unconditionally guaranteed against defects in material and workmanship, including settling of backfilled areas below grade and adjusting heads to proper level for a period of one year from date of acceptance.

B. In addition to minor adjustments, any defective electrical controls, valves, sprinkler heads or other working parts will be repaired or replaced without cost to the Facility Manager for a period of one year from date of acceptance.

C. Contractor to provide one winterization and spring start up of irrigation system.

D. Damage by others during the one-year guarantee period will be the Facility Manager's responsibility.

4.03 RECORD INFORMATION

A. Furnish record drawings of the complete irrigation system.

B. Record Drawings and Controller Chart:
   1. Provide a complete set of up-to-date as built drawings, and an electronic copy (BIM or AutoCAD release 2018 or newer).
   2. Prepare a controller chart showing:
      a. Location of all sections, valves, lateral lines, and routes of control wires.
      b. Identify all valves as to size, station, number, and type of irrigation.
      c. Provide chart as a black-line print with a different color used to show area of coverage for each station.
      d. Locate chart inside controller door. Seal chart between two pieces of plastic.
      e. Provide suggested irrigation schedule at time of acceptance.
      f. Complete chart and receive approval prior to final inspection of irrigation system.

PART 5 IRRIGATION MANAGEMENT DURING ESTABLISHMENT PERIOD

5.01 ESTABLISHMENT PERIOD

A. Plant Establishment Period (PEP) begins on the date that initial planting operations (Substantial Completion) on the project are completed and continues until final acceptance of the project, and will last for the following period:
   1. 90 Days.
   2. 2 growing seasons. (as defined by Landscape Architect for project location)
   3. 2 calendar years.

5.02 ESTABLISHMENT WORK

A. Keep irrigation operational in accordance with the Landscape Standards throughout the establishment period and submit Life Time Landscape Contractor Inspection Reports. Perform irrigation inspection work throughout the growing seasons and as necessary during the dormant seasons (as defined by Landscape Architect). The Landscape Architect may perform inspections throughout the PEP to verify compliance. The Landscape Architect will consider the Contractor non-compliant if the Contractor does not maintain the irrigation system throughout the PEP and does not submit Inspection reports.

5.03 ALL IRRIGATION

A. During the establishment period, perform the following:
   1. Inspect to assess the condition of the irrigation system and factors that may influence function and watering efficiencies. Inspect these conditions at least every two weeks during the growing season and at least every month during the dormant season;
   2. Submit a written Inspection report to the Landscape Architect via e-mail by the 1st and 15th of each month during the growing season and by the 1st of each month during the dormant season. The Landscape Architect will use the report-frequency and content to assess irrigation system compliance. The report may include scanned copies of the plan sheets with the Contractor notes, copies of the report form found in the Life Time Landscape Standards Manual. Include the following in the report:
      a. The project number.
      b. Engineer's name.

c. Name of Contractor's responsible scout or representative.
d. Dates work was performed.
e. Work locations.
f. Work completed.
g. Prevailing weather conditions.
h. Soil moisture assessments.
i. Insect, animal, vehicular, weather, or other damage.
j. System problems.
k. Modifications or recommendations.
l. Assessment of overall irrigation system.

3. Maintain soil moisture in accordance with the watering guidelines of the standard planting details shown on the plans.
4. Adjust irrigation controller to maintain the optimal balance of watering for the entire site and its plant material.
5. Repair, adjust, or replace broken, malfunctioning or inefficient components or parts in accordance with the irrigation design.
6. Provide and install replacement parts in accordance with Replacement Requirements and according to Construction Drawings and Specifications.
7. Prevent or repair damage that may lead to soil erosion and overwatering.
8. Perform irrigation operations consistent with irrigation practices detailed in the Life Time Landscape Standards.

5.04 REPLACEMENT REQUIREMENTS

A. Within the first half of the PEP, determine which irrigation components need replacing. Replace parts in accordance with initial installation requirements, including irrigation damage due to accidents, vandalism, theft, rodent damage, damage caused by the Contractor, or if ordered by the Landscape Architect, at no additional cost to the Owner. Conduct irrigation replacement operations as needed within the first half of the PEP. At least one week before irrigation replacement, submit a summary report of proposed irrigation replacements to the Landscape Architect. Include by attachment, copies of plan sheets with the proposed replacement parts and locations identified and a Life Time Certificate of Compliance for Irrigation, Irrigation Material, and Equipment, in the report. Using brightly colored paint, mark on site irrigation requiring replacement. Provide replacement irrigation parts and incidental materials that are equal to or better than the initial material required by the contract.

5.05 FINAL ACCEPTANCE

A. As a condition for terminating the PEP and conducting the final inspection, the Landscape Architect and Facility Manager may require the Contractor to bring the irrigation system work into compliance. At the end of the PEP, the Landscape Architect and Facility Manager along with the Establishment Contractor will perform a final inspection of the project.

5.06 TRANSITION TO LONG TERM MAINTENANCE

A. Upon final acceptance, the project will transition from Establishment Contractor maintenance of the irrigation system to Long Term Maintenance. A coordination meeting to transition from the Establishment Contractor to Long-Term Maintenance Contractor will take place one week prior to conclusion of the Establishment period to ensure all requirements are met and the Long-Term Contractor understands their role and when they will take over Maintenance.

END OF SECTION

SECTION 32 84 23

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install planting irrigation system as described in Contract Documents complete with accessories necessary for proper function.

B. Related Requirements:
   1. Section 32 9223: Sodding.

1.2 REFERENCES

A. Definitions:
   1. Automated Self Flushing Wye Strainer: Wye strainer located immediately downstream from point of connection in-lieu of backflow prevention device for irrigation systems that utilize non-potable, secondary and/or reclaimed water that is automatically self-flushing to control unwanted debris from infiltrating remaining irrigation system.
   2. Dielectric Fittings: Special type of fitting used between dissimilar metals to prevent galvanic action from causing corrosion failure.
   3. 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.
   4. Non-Pressure Lateral Line: Downstream from electric control valves to pop-up spray heads and drip valve assemblies to emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
   5. Peak Flow: Maximum required flow for given month based on six (6) day week, nine (9) hour day watering window to be used for irrigation system design and to be used in hydraulic analysis.
   6. Point of Connection: Location where meter for irrigation system is located.
   7. Pressure Supply Line: Downstream from point of connection to electric control valves. Piping is under water-distribution-system pressure when activated by master valve or hydrometer. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
   8. SMART Controllers: Smart controllers are irrigation clocks that automatically adjust irrigation run times in response to environmental changes using sensors and weather information to manage watering times and frequency. As environmental conditions vary, controller increases or decreases irrigation. Smart controllers have ability to turn off your sprinklers automatically during rain, high wind or low temperature.
   9. Static Water Pressure: Pressure at point of connection when system is not operable.
   10. Two Wire Path: Conducts power to solenoid valves, and also conducts communications signals from SMART controller to each device on system. Sensors receive instructions to take readings, transmit data and perform other tasks; solenoid valves and other devices also receive commands from controller over same wires used to carry power to valves. For new construction, total length of wire in system is limited to 10,000 ft (3 048 m); maximum distance from any system device to controller is 4000 ft (1 220 m). Wire loops are permissible, but length of wire in loop is limited to 2000 ft (610 m). For normal installation, it is recommended that paired wire be installed with 1 in 5 foot (0.305 in 1.500 m) twist to reduce effects of nearby noise sources on communications. Heavy electromagnetic fields such as produced by overhead high tension power lines or near-by generator, transformers or large pump motors can interfere with data signals and generate communications errors over the cable. In such conditions, it is imperative that wire receive 1 in 5 foot (0.305 in 1.500 m) twist when installed.
   11. Working Pressure: Pressure at point of connection when system is operable.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Schedule pre-installation conference before irrigation system installation begins.
   2. Review the following:
      a. Landscape architect or designated landscape consultant shall demonstrate or describe method to be used to maintain head spacing from concrete and to stabilize heads.
      b. Within the field yard, provide one installed example of each type of irrigation detail for review and approval by the architect and owner prior to beginning work in the field.

B. Sequencing:
   1. Install sleeves before installation of cast-in-place concrete site elements and paving.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's cut sheets for each element of system.
      b. Parts list for operating elements of system.

B. Informational Submittals:
   1. Certificates:
      a. Acceptance certificate of irrigation system.
         1) Upon acceptance of irrigation system, reviewer will provide signed acceptance certificate.
         2) Certificate will include name and signature of reviewer, reviewer's company, date of review, and reviewer's telephone number.
   2. Test And Evaluation Reports:
      a. Results of mainline service pressure test before beginning work on system should be submitted as a report following the testing and before burial of the mainline.
      b. Provide the following from Main Line Irrigation test and observation:
         1) Record and submit documentation of Irrigation Main Line tests, issues, and measure taking to correct problems.
   3. Manufacturer Instructions:
      a. Manufacturer's printed literature on operation and maintenance of operating elements of system.
      b. Instruction Manual:
         1) Includes complete directions for system operation and maintenance, including winterizing, controller program worksheet and annual service and scheduling calendar based on local site specific conditions.
      c. Complete instructions on how to drain entire backflow preventer to prevent freezing.
   4. Qualification Submittals:
      a. Irrigation Installer:
         1) Provide documentation of the following:
            a) Firm experience in irrigation projects (minimum of five years)
            b) Financial stability.
            c) Comply with specifications and contract documents.
            d) Agree to complete reporting documents, including:
               (1) Assist landscape architect in completing the Watering Schedule for Site Management Plan (SMP).

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual:
      a. Operations And Maintenance Data:
         1) Instruction Manual.
         2) Manufacturer's printed literature.
         3) Manufacturer's cut sheets for each element of system.
         4) Manufacturer’s parts list.
         5) Main Line Irrigation observation report.
         6) Controller Program Schedule.

b. Record Documentation:
1) Certificates:
a) Acceptance certificate of irrigation system.
2) Testing and Inspection Reports:
a) Mainline Pressure Test.
b) Main Line Irrigation test and observation.
3) Record drawings: As installation occurs, prepare accurate record drawing to be submitted before final inspection, including:
a) Detail and dimension changes made during construction.
b) Significant details and dimensions not shown in original Contract Documents.
c) Field dimensioned locations of valve boxes, manual drains, quick-coupler valves, control wire runs not in mainline ditch, soil moisture sensors (if soil moisture sensor technology is selected for the site) and both ends of sleeves.
d) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
e) Take and record dimensions at time of installation.
f) Reduced copy of record drawings to 11 by 17 inches (275 by 425 mm), with color key circuits and laminated both sides with 5 mil thick or heavier plastic.
g) Two (2) additional reduced copies of record drawings to 11 by 17 inches (275 by 425 mm), with color key circuits, unlaminated, and unmounted to be given to Owner's Representative.

2. Final payment for system will not be authorized until Closeout Submittals are received and accepted by Architect and landscape consultant.

D. Maintenance Material Submittals:
1. Tools:
a. Furnish following items before Final Closeout Review:
1) One quick coupler key with brass hose swivel.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws.
2. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.

B. Qualifications:
1. Installer Qualifications:
a. General:
1) Perform installation under direction of foreman or supervisor with five (5) years minimum experience in sprinkling system installations.

C. Mockups:
1. Provide Mock-Ups of each detail within a valve box at the staging area for review by Landscape Architect prior to installation of the irrigation system.
2. These mock-ups may be installed without solvent weld cement so that they can later be used in the field.
3. Mock-ups shall include a complete installation included filter fabric, gravel sump, equipment assembly, valve box placement and branding in conformance with these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Storage and handling during installation, protect materials from damage and prolonged exposure to sunlight.

1.7 WARRANTY

A. Manufacturer Warranty:
   1. Standard one year guarantee shall include:
      a. Filling and repairing depressions and replacing plantings due to settlement of irrigation system trenches.
      b. Adjusting system to supply proper coverage of areas to receive water.
      c. Ensuring system can be adequately drained.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Manufacturer Contact List (for reference only, not all may be included in this project):
      a. 3M, Austin, TX www.3m.com/elpd.
      b. Acclima, Inc. Meridian, ID www.acclima.com.
      c. Action Machining Inc, Bountiful, UT www.actionfilters.com.
      d. Amiad www.amiadusa.com.
      e. Apollo Valves by Conbraco Industries, Matthews, NC www.apollovalves.com.
      f. Carson Industries LLC, Glendora, CA www.carsonind.com.
      g. GPH Irrigation Products, Fontana, CA www.gphirrigation.com.
      h. Harrington Corporation (Harco), Lynchburg, VA www.harcofittings.com.
      i. Hunter Industries, San Marcos, CA www.hunterindustries.com.
      j. HydroPoint Data Systems, Inc., Petaluma, CA www.hydropoint.com.
      k. HydroRain, North Salt Lake, UT www.hydrorain.com.
      l. King Innovation, St Charles, MO www.kinginovation.com.
      m. IPS Corporation, Compton, CA www.ipscorp.com.
      n. Leemco, Colton, CA www.leemco.com.
      o. Netafim, Inc. www.netafimusa.com.
      p. Nibco Inc, Elkhart, IN www.nibco.com.
      q. Northstar Industries, LLC, Methuen MA www.northstarind.com.
      r. Orbit Irrigation Products, Inc. Bountiful, UT www.orbitonline.com.
      s. Paige Electric, Union, NJ www.paigewire.com.
      t. Rain Bird Sprinkler Manufacturing Corp, Glendora, CA www.rainbird.com.
      u. Rain Master, Simi Valley, CA www.rainmaster.com.
      v. Salco by Weathermatic Irrigation Products, Garland, TX www.weathermatic.com.
      w. Toro Company, Irrigation Div, Riverside, CA www.toro.com.
      x. T. Christy Enterprises, Inc. (Christy's), Anaheim, CA www.tchristy.com.
      y. Valve and Filter Corporation, Arvada, CO www.valveandfilterlcom.
      z. Weathermatic Irrigation Products, Garland, TX www.weathermatic.com.
      aa. Wilkins a Zurn Company, Paso Robles, CA www.zurn.com.

B. Materials:
   1. Rock-Free Soil:
      a. Backfill soil around PVC pipe.
      b. Soil having rocks no larger than 1/2 inch (13 mm) in any dimension.
   2. Pea Gravel:
      a. For use around drains, valves, and quick couplers.
      b. 1/2 inch (13 mm) maximum dimension, washed rock.
   3. Sand: Fine granular material naturally produced by rock disintegration and free from organic material, mica, loam, clay, and other deleterious substances.
   4. Native Material: Soil native to project site free of wood and other deleterious materials and rocks over 1-1/2 inches (38 mm).
   5. Topsoil: Remove rocks, roots, sticks, clods, debris, and other foreign matter over 1-1/2 inches (38 mm) longest dimension encountered during trenching.
   6. Pipe, Pipe Fittings, And Connections:
      a. Pipe shall be continuously and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.

b. Pipe sizes shown on Drawings are minimum. Larger sizes may be substituted if at no additional cost to Owner.
c. Pipe:
1) Pressure Lines: Schedule 40 PVC.
2) Lateral Lines: Schedule 40 PVC.
3) Backflow Prevention Assembly Piping: Brass.
4) Quick Coupler Piping: Galvanized steel.
d. Fittings: Same material as pipe, except where detailed otherwise.
1) Mainline Fittings: Schedule 80 PVC of matching size.
2) Lateral Line Fittings: Schedule 40 PVC of matching size.
3) Use dielectric union fittings between dissimilar metal pipes and fittings.
e. Sleeves:
1) Under Parking Area And Driveway Paving: Schedule 40 PVC Pipe.
2) All Other: Class 200 PVC Pipe.
3) Sleeve diameter shall be two times larger than pipe installed in sleeve.

7. Sprinkler Heads:
a. Each type of head shall be product of single manufacturer.
b. Spray Heads:
1) Approved Products:
a) Rain Bird RD 4” pop-up with SAM and PRS options and MPR nozzles.

8. Sprinkler Risers:
a. Pop-up spray heads shall have risers made up one of the following ways:
1) Three (3) schedule 40 street ells or marlex street ells connected to lateral tee to form an adjustable riser or pop-up riser as detailed.
2) Risers for sprinkler heads 14 inches (355 mm) long minimum and 24 inches (610 mm) maximum.
a) Acceptable Products:
(1) Hunter: SJ series with barbed fittings.
(2) Hydro-Rain: Blu-lock Swing pipe & fittings.
(3) Rainbird: Swing Pipe with barbed fittings.
(4) Toro: Super Funny Pipe with barbed fittings, SPFA-5125, SPFA-51275.
(5) Equal as approved by Architect before installation.

9. Automatic Irrigation Controller and Control Wiring:
a. Automatic Controllers:
1) Rain Bird ESP-LXME Modular Controller. Provide and install Rain Bird WR2RFC-48 wireless rain/freeze sensor combo as per manufacturer specifications and details.
b. Control Wiring:
1) Traditional control wire shall be UF-UL listed, color coded PE insulated copper conductor direct burial size 14. For wire runs exceeding 3,300 feet (1 005.84 meter), use 12 AWG wire. Do not use green color coded wire.
2) Paige Electric Cadweld Connection.
3) Waterproof Wire Connectors:
a) Control wire connections shall consist of properly-sized wire nut inserted in waterproof grease cap:
b) Acceptable Products:
(1) DBY or DBR by 3M.
(2) 'One Step' 20111SP by King Innovation.
(3) DB 57905, 57505 by Orbit.
(4) Equal as approved by Architect before installation.
c. Conduit:
1) Exterior applications or inside mechanical shed:
a) Galvanized IMC. Where in contact with earth or concrete, wrap galvanized IMC conduit and fittings completely with vinyl tape.
2) In-ground: commercial grade grey conduit.
3) Size conduit as follows:

Galvanized IMC Conduit

Wire Size (AWG)	Number of Wires					
14	7	13	22	32	47	67
12	6	8	18	25	38	59
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)

PVC Sch. 40 Conduit

Wire Size (AWG)	Number of Wires					
14	6	11	20	29	43	61
12	5	7	17	23	35	54
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)

PVC Sch. 80 Conduit

Wire Size (AWG)	Number of Wires					
14	5	9	17	24	39	55
12	4	6	14	19	32	49
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)

d. Lightning Arrestor:
   1) Provide grounding and Lightning Arrestor(s) as required by Manufacturer.
   2) Valve Boxes
      a) Acceptable Products:
         (1) Hydro-Rain: ProSeries: 10 inch (255 mm) VB 0910.
         (2) Carson Industries: 10 inch (255 mm) Model 0910.
         (3) Equal as approved by Architect before use.
      b) Valve Box Supports:
         (1) Standard size fired clay paving bricks without holes.

10. Valves:
   a. Manual Drain Valves:
      1) Brass ball valve with 'T' handle on main lines and in valve boxes on lateral lines.
      2) Approved Products:
         a) Apollo Valves: 78-621-01 series ball valve, ¾ inch
   b. Automatic Valves:
      1) Approved Products:
         a) Rain Bird PEB series
   c. Isolation Valves:
      1) Approved Products:
         a) Nibco T-113 non-rising stem gate valve, size to match pipe size.
         b) Nibco ductile iron resilient wedge with square operating nut.
   d. Backflow Prevention Assembly: Wilkins 375XLB theft prevention reduced pressure type.
   e. Quick Coupling Valves and Keys:
      1) Approved Products:

a) Rain Bird 33-DRC series and SH-O swivel hose ell.

11. Valve Accessories:
    a. Valve Boxes And Extensions:
        1) Lid Colors:
            a) Green: Lawn areas (potable and secondary water).
            b) Tan: Bare soil and rock areas (potable and secondary water).
            c) Purple: Reclaimed water.
        2) Acceptable Products:
            a) Hydro-Rain: ProSeries:
                (1) 12 inch (300 mm) VB1419 (standard).
                (2) 10 inch (255 mm) VB 0910.
            b) Carson Industries:
                (1) 12 Inch (300 mm) Model 1419-12.
                (2) 10 Inch (255 mm) Model 0910.
            c) Equal as approved by Architect before use.
    b. Valve ID tags:
        1) Acceptable Products:
            a) Christy's: Stamped ID tag.
            b) Equal as approved by Architect before use.
    c. Valve Box Supports:
        1) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.
12. Drip System:
    a. Drip Valve Assembly:
        1) Approved Products:
            a) Rainbird:
                (1) Over 6 GPM: XCZ-150-PRB-COM series (15-40 gpm).
                (2) Over 4 GPM: XCZ-100-B COM series (3-20 gpm).
                (3) Under 4 GPM: XCZ-075-PRF series.
    b. Distribution Tubing (from lateral lines to emitter):
        1) Acceptable Products:
            (a) Hunter: SJ series with barbed fittings.
            (b) Hydro-Rain: Blu-lock Swing pipe & fittings.
            (c) Rainbird: Swing Pipe with barbed fittings.
            (d) Toro: Super Funny Pipe with barbed fittings, SPFA-5125, SPFA-51275.
            (e) Equal as approved by Architect before installation.
    c. Drip Emitters – Trees, Shrubs & Ornamental Grasses:
        1) Approved Products:
            a) GPH: Model Specflow GPSTCV Spec-Check PC "Desert Camo" color.
    d. Valve Box Supports:
        1) Standard size fired clay paving bricks without holes.
        2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.
13. Solvent Cement:
    a. Approved Products:
        1) Primer:
            a) Meet ASTM F656 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*
            b) Meet NSF/ANSI standard for use on potable water applications.
            c) Low VOC emissions and compliant with LEED.
            d) Product: Weld-On P-70 primer by IPS.
        2) PVC Solvent Cement:
            a) Heavy bodied, medium setting, high strength:
                (1) Meet ASTM D2564 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*
                (2) Meet NSF/ANSI standard for use on potable water applications.
                (3) Meet CSA standards for use in pressure and non-pressure potable water applications.
                (4) Low VOC emissions and compliant with LEED.
                (5) Product: Weld-On 711 Low VOC PVC Cement by IPS.
            b) Flexible, medium bodied, fast setting, high strength (flexible pipe only):
                (1) Meet ASTM D2564 standard and applicable sections of latest edition of *'Uniform Plumbing Code'.*

(2) Meet NSF/ANSI standard for use on potable water applications.
(3) Low VOC emissions and compliant with LEED.
c) Product: Weld-On 795 Low VOC Flex PVC Cement by IPS.

14. Other Components:
    a. Recommended by Manufacturer and subject to Architect's review and acceptance before installation.
    b. Provide components necessary to complete system and make operational.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
    1. Perform pressure test at stub-out on main water line provided for irrigation system, or at near-by fire hydrant.
    2. Notify Architect if pressures over 70 psi (480 kPA) or under 55 psi (379 kPA) are found to determine if some re-design of system is necessary before beginning work on system.

3.2 PREPARATION

A. Protection:
    1. Protection of In-Place Conditions:
        a. Repair or replace work damaged during course of the Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.
        b. Do not cut existing tree roots measuring over 2 inches (50 mm) in diameter in order to install irrigation lines.

B. Surface Preparation:
    1. Layout of Irrigation Heads:
        a. Location of heads and piping shown on Drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc.
        b. During layout, consult with Architect to verify proper placement and make recommendations, where revisions are advisable.
        c. Minor adjustments in system layout will be permitted to avoid existing fixed obstructions.
        d. Make certain changes from Contract Documents are shown on record drawings.

3.3 INSTALLATION

A. Trenching And Backfilling:
    1. Pulling of pipe is not permitted.
    2. Excavate trenches to specified depth. Remove rocks larger than 1-1/2 inch (38 mm) in any direction from bottom of trench. Separate out rocks larger than 1-1/2 inch (38 mm) in any direction uncovered in trenching operation from excavated material and remove from areas to receive landscaping.
    3. Cover pipe both top and sides with 2 inches (50 mm) of rock-free soil as specified under PART 2 PRODUCTS. Remainder of backfill to within 5 inches (125 mm) of finish grade shall be as specified in Section 31 2323. Top 5 inches (125 mm) of backfill shall be topsoil as specified in Section 32 9113.
    4. Do not cover pressure main, irrigation pipe, or fittings until Architect has inspected and approved system.

B. Sleeving:
    1. Sleeve water lines and control wires under walks and paving. Extend sleeves 6 inches (150 mm) minimum beyond walk or pavement edge. Cover sleeve ends until pipes and wires are installed to keep sleeve clean and free of dirt and debris.

2. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.

C. Grades And Draining:
1. In localities where winterization is required, grade piping so system can be completely drained or blown out with compressed air. If system is not designed to be blown out with compressed air:
   a. Slope pipe to drain to control valve box where possible.
   b. Where this is not possible, slope pipe to a minimum number of low points. At these low points, install:
      1) 3/4 inch (19 mm) brass ball valve for manual drain. Do not use automatic drain valves.
      2) Install 2 inch (50 mm) Class 200 PVC pipe over top of drain and cut at finish grade.
      3) Provide rubber valve cap marker.
      4) Provide one cu ft (0.03 cu m) pea gravel sump at outlet of each drain.
   c. Slope pipes under parking areas or driveways to drain outside these areas.
   d. Provide and install quick-coupling valve or valves in location for easy blowout of entire system. Install quick coupler valves with 4 lineal feet (1.20 m) minimum of Schedule 80 PVC pipe between valve and main line.

D. Installation of Pipe:
1. Install pipe in manner to provide for expansion and contraction as recommended by Manufacturer.
2. Unless otherwise indicated on Drawings, install main lines and lateral lines connecting pop-up rotor and impact sprinklers with minimum cover of 18 inches (450 mm) based on finished grade. Install remaining lateral lines, including those connecting drip tubing, with minimum of 12 inches (300 mm) of cover based on finish grade.
3. Install pipe and wires under driveways or parking areas in specified sleeves 18 inches (450 mm) below finish grade or as shown on Drawings.
4. Locate no sprinkler head closer than 12 inches (300 mm) from building foundation. Heads immediately adjacent to mow strips, walks, or curbs shall be one inch (25 mm) below top of mow strip, walk, or curb and have one to 3 inches 75 mm clearance between head and mow strip, walk, or curb.
5. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
6. Make solvent weld joints as follows:
   a. Do not make solvent weld joints if ambient temperature is below 35 deg F (2 deg C).
   b. Clean mating pipe and fitting with clean, dry cloth and apply one coat of P-70 primer to each.
   c. Apply uniform coat of 711 solvent to outside of pipe.
   d. Apply solvent to fitting in similar manner.
   e. Give pipe or fitting a quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
   f. Allow joints to set at least 24 hours before applying pressure to PVC pipe.
7. Tape threaded connections with teflon tape.
8. If pipe is larger than 3 inches (75 mm), install concrete thrust blocks wherever change of direction occurs on PVC main pressure lines.

E. Control Valves And Controller:
1. Install valves in plastic boxes with reinforced heavy duty plastic covers. Locate valve boxes within 12 inches (300 mm) of sidewalks and shrub bed edges with tops at finish grade. Do not install more than two valves in single box.
2. Place 3 inches (75 mm) minimum of pea gravel below bricks supporting valve boxes to drain box. Set valve boxes over valve so all parts of valve can be reached for service. Set cover of valve box even with finish grade. Valve box cavity shall be reasonably free from dirt and debris.
3. Wiring:
   a. Tape control wire to side of main line every 10 feet (3.050 m). Where control wire leaves main or lateral line, enclose it in gray conduit.
   b. Use waterproof wire connectors consisting of properly-sized wire nut and grease cap at splices and locate all splices within valve boxes.
   c. Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one controller.
   d. Run one spare control wire from panel continuously from valve to valve throughout system similar to common wire for use as a replacement if a wire fails. Spare wire shall be different color than other wires, except use of green wire is not acceptable. Mark spare control wire in control box as an unconnected wire. Extend spare control wires 24 inches (600 mm) and leave coiled in each valve box.

F. Drip Assembly:
1. Install pipe providing for expansion and contraction as recommended by Manufacturer.
2. Cut tubing square and remove burrs at cut ends.
3. Distribution tubing shall be between 14 inches (350 mm) minimum and 48 inches (1 200 mm) maximum long. Layout PVC lateral lines as necessary to keep distribution tubing lengths within specified tolerances.
4. Locate drip emitter on uphill side of plant within rootball zone.
5. Layout in-line tubing for trees as indicated on Contract Drawings. Layout in-line tubing for shrubs and groundcovers so plants receive water within rootball zones.
6. Locate in-line tubing on top of soil but under bark mulch and weed barrier fabric.
7. Staple in-line tubing to ground at 3 foot (900 mm) to 5 foot (1 500 mm) maximum intervals (sand = 3 foot (900 mm), loam = 4 foot (1 200 mm), clay = 5 foot (1 500 mm) and within 12 inches (300 mm) of ends and intersections.
8. Assembly Using 'Funny Pipe' Type Joints:
   a. Connect distribution tubing to lateral line using barbed ell fitting.
   b. Connect fitting to distribution tubing using straight barbed fitting with 1/2 inch (13 mm) threaded end.

G. Sprinkler Heads And Rotor Pop-ups:
1. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
2. Do not install sprinklers using side inlets. Install using base inlets only.
3. Heads immediately adjacent to mow strips, walks, or curbs shall be one inch (25 mm) below top of mow strip, walk, or curb and have one inch (25 mm) to 3 inch (75 mm) clearance between head and mow strip, walk, or curb.
4. Set sprinkler heads at consistent distance from walks, curbs, and other paved areas and to grade by using specified components or other method demonstrated in Pre-Construction Conference.

H. Before installation of sprinkler heads, open control valves and use full head of water to flush out system.

I. Arrange valve stations to operate in an easy-to-view progressive sequence around building. Tag valves with waterproof labels showing final sequence station assignments.

3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
1. Irrigation System:
   a. Pressure Test:
      1) In presence of Landscape Architect, provide pressure test. Notify Landscape Architect two (2) working days minimum before conducting test.
      2) Before backfilling main line, test pressure at 100 psi (690 kPA) minimum for two (2) hours minimum and make certain there are no leaks.
   b. Test report:
      1) Report of Pressure Test results along with photographs of testing process are to be provided to Architect and Landscape Architect or his authorized representative at completion of testing.
      2) Pressure test report shall be included in Operations and Maintenance Manual.
2. Pre-Substantial Inspection:
   a. Landscape Architect or designated representative(s) will inspect system to verify completeness approximately two (2) weeks prior to Substantial Completion.
   b. Approval of irrigation system to be in writing.
3. Substantial Completion Walkthrough:
   a. Landscape Architect or designated representative(s) will inspect site and create list of non-conforming items to be resolved prior to Irrigation Final Acceptance. Date on this list will act as date of Landscape Substantial Completion.
   b. Installations completed after water source has been turned off for season, as determined by Landscape Architect, will be inspected following spring after system can be checked for proper operation.
4. Irrigation Final Acceptance:
   a. Irrigation Final Acceptance will be awarded when all non-conforming work is brought into conformance.

b. Landscape Architect will create signed certificate to be included in Operations and Maintenance Manual at completion of all non-conforming work.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Underground Sprinkler System:
a. Correct any work found defective or not complying with Contract Document requirements at no additional cost to the Owner.

3.5 ADJUSTING

A. Sprinkler Heads:
1. Adjust sprinkler heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering and raising of sprinkler heads shall be part of original contract with no additional cost to Owner.
2. Adjust sprinkler heads for proper distribution and trim so spray does not fall on building.

B. Watering Time:
1. Adjust watering time of valves to provide proper amounts of water to plants.

3.6 CLOSEOUT ACTIVITIES

A. Training:
1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance procedures using Landscape Management Plan (LMP).
a. Describe difference between plant establishment schedule and long-term maintenance schedule.
b. Describe annual and regular filter maintenance.

B. Winterization and Spring Start-Up:
1. During first year of operation, Installer shall shut-down irrigation system prior to freezing temperatures and re-start irrigation system at beginning of growing season:
a. Winter Shut-Down is intended to remove all potentially damaging water from irrigation system. Perform following as well as any other efforts necessary to properly winterize system:
1) Turn off water source at point of connection.
2) Blow out system with pressurized air, turning on each valve until water is cleared out of system. Run through system twice. Only blow out components suitable to receive pressurized air. Hydrometers, for instance, should not be blown out. Do not use excessive air pressure that will damage pipes and parts.
3) Turn controller off.
4) Open all manual drain valves.
5) Drain, wrap, protect, or remove any backflow device exposed to freezing temperatures using manufacturer’s recommendations and best practices. Coordinate method with Owner’s Representative.
6) Drain and remove pumps for Owner’s Representative storage.
7) Drain filters using manufacturer’s recommendations.
8) Check sprinkler heads to make sure they are below sidewalk and curb levels and not vulnerable to snowplow damage. Lower heads to proper elevation.
9) Notify Owner’s Representative when system has been turned off.
b. Spring start-up shall include following:
1) Close all manual valves.
2) Clean pump filters and replace if necessary.
3) Remove freeze protection as required.
4) Turn on water source at point of connection.
5) Verify that controller(s) and rain sensor are properly operating. Change battery in controller(s) and sensor(s) as required.
6) Flush entire system. Run each valve for two (2) minutes to check for damage, leaks, and coverage.

7) Repair and adjust system as needed. Fine tune heads for efficient coverage.
8) Notify Owner's Representative when system has been charged and is in full repair.

END OF SECTION

SECTION 32 9001

COMMON PLANTING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common procedures and requirements for landscaping work.
   2. Provide maintenance for new landscaping as described in Contract Documents.

B. Related Requirements:
   1. Pre-Installation conferences held jointly with Section 32 9001 as described in Administrative Requirements on Part 1 of this specification section:
   2. Section 32 8423: 'Irrigation System'
   3. Section 32 9120: ‘Topsoil and Placement’
   4. Section 32 9122: ‘Topsoil Grading’
   5. Section 32 9300: 'Plants'

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference held jointly with following sections:
      a. Section 32 8423: 'Irrigation System'
      b. Section 32 9120: ‘Topsoil and Placement’
      c. Section 32 9122: ‘Topsoil Grading’
      d. Section 32 9300: 'Plants'
   2. Review the following:
      a. Site Visits:
         1) Landscape Architect to visit site five (5) times during project construction.
         2) If site conditions necessitate additional visits, Landscape Architect can schedule addition site visits with approval from Architect prior to bid.
         3) During construction, addition site visits may be approved in writing by Architect or Owner for special considerations before commencement.
         4) Site visits caused by lack of work progress by Landscape Subcontractor shall reimburse Landscape Architect amount determined by Architect or Owner for additional site visits.
      b. Coordination:
         1) Landscape Subcontractor and Landscape Architect to coordinate site visits and include Architect and General Contractor in communications.
      c. Landscape Maintenance:
         1) Establish responsibility for maintenance of new landscaping during all phases of construction period.
      d. Percolation Test:
         1) Prepare two (2) typical landscape planting excavations and conduct percolation test to verify that water drains away within two (2) hours.
         2) Discuss results of percolation tests with Architect and Owner's Representative.
      e. Review additional agenda items as specified in related sections listed above.
   3. Approved Site Visits:
      a. Site Visit No. 1:
         1) Description:
            a) Landscape pre-installation Conference.
         2) Schedule: Conduct pre-installation conference after completion of Fine Grading specified in Section 31 2216, but one (1) week minimum before beginning landscape work.
         3) Required Attendees:
            a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Excavator, and Landscape Architect.
            b) Include Landscaping Subcontractor Foreman and those responsible for installation of landscaping to be in attendance.

4) Related Sections:
   a) Section 32 8423: 'Underground Sprinklers'
   b) Section 32 9120: 'Topsoil and Placement'
   c) Section 32 9122: 'Topsoil Grading'
   d) Section 32 9223: 'Sodding'
   e) Section 32 9300: 'Plants'
5) Notes:
   a) Verify project site conditions and review scope of work before installation begins.
   b) Verify appropriate sub-grades have been established.

b. Site Visit No. 2:
1) Description:
   a) Irrigation system pressure test compliance, main line inspection, valve inspection.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning irrigation system pressure test.
3) Required Attendees:
   a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
   a) Project Manager, Facilities Manager.
5) Related Sections:
   a) Section 32 8423: 'Underground Sprinklers'
   b) Section 32 9120: 'Topsoil and Placement'
   c) Section 32 9122: 'Topsoil Grading'
6) Notes:
   a) Verify finish grading in preparation for planting.

c. Site Visit No. 3:
1) Description:
   a) Inspect and approve plant quality, plant quantity, plant pits, plant pit backfill, planting depths, and removal of packaging/distribution materials, wire, and ties.
2) Schedule: Conduct site visit one (1) week minimum after notification from Contractor before beginning site visit no. 3.
3) Required Attendees:
   a) General Contractor, Landscape Subcontractor, Landscape Architect.
4) Recommended Attendees:
   a) Project Manager, Facilities Manager.
5) Related Sections:
   a) Section 32 9300: 'Plants'
6) Notes:
   a) Inspect irrigation system installation, Inspect weed barrier fabric.

d. Site Visit No. 4:
1) Description:
   a) Comprehensive Substantial Completion inspection prior to beginning thirty (30) day Landscape Subcontractor maintenance period.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 4.
3) Required Attendees:
   a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Landscape Architect.
4) Related Sections:
   a) Section 32 8423: 'Underground Sprinklers'
   b) Section 32 9300: 'Plants'
5) Notes:
   a) Verify contract requirements have been followed including but not limited to: planting compliance, irrigation system coverage and irrigation system operation.

e. Site Visit No. 5:
1) Description:
   a) At the end of thirty (30) day Landscape Subcontractor maintenance period, verify deficient items have been corrected and verify no others exist.
2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 5.
3) Required Attendees:
   a) Project Manager, Facilities Manager, Architect, General Contractor, Excavation Subcontractor, Landscape Subcontractor, Landscape Architect.

4) Related Sections:
   a) Section 32 8423: 'Underground Sprinklers'
   b) Section 32 9300: 'Plants'
5) Notes:
   a) Review Site Management Plan (SMP) with Owner. Provide landscape maintenance training.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Special Procedure Submittals:
      a. Landscape Architect and Landscape Subcontractor shall jointly provide the following:
         1) Maintenance recommendations for Site Management Plan (SMP).
         2) Recommendation procedures to be established by Owner for maintenance of landscape work for one (1) full year after contract maintenance period ends required by Contract Documents.
   2. Qualification Statement:
      a. Landscape Subcontractor:
         1) Provide Qualification documentation if requested by Landscape Architect or Owner.
      b. Installer:
         1) Provide Qualification documentation if requested by Landscape Architect or Owner.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual:
      a. Maintenance:
         1) Maintenance recommendations for Site Management Plan (SMP).
      b. Operations And Maintenance Data:
         1) At completion of landscape work, submit two (2) copies of typewritten instructions of the following:
            a) Provide maintenance recommendations for Site Management Plan (SMP).
            b) Provide recommended procedures to be established by Owner for maintenance of landscape work for one (1) full year after contract maintenance period ends.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Landscape Subcontractor:
      a. Company specializing in performing work of this section.
      b. Minimum five (5) years experience in landscaping installations.
      c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      d. Upon request, submit documentation.
   2. Installer:
      a. Planting shall be performed under direction of foreman or supervisor with minimum three (3) years experience in landscape installations similar in size, scope, and complexity.
      b. Foreman or supervisor required to attend pre-installation conference.
      c. Use trained personnel familiar with required planting procedures and with Contract Documents.
      d. Upon request, submit documentation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
   1. Deliver packaged materials in containers showing weight, analysis, and name of Manufacturer.
   2. Deliver sod, plants, trees, and shrubs in healthy and vigorous condition.
   3. Protect materials from deterioration during delivery.

B. Storage And Handling Requirements:
   1. 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.
   2. Protect materials from deterioration while stored at site.

PART 2 - PRODUCTS

2.1 N/A

PART 3 - EXECUTION

3.1 EXAMINATION

Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Verification Of Conditions:
   1. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, ground lighting, and utilities.

3.3 PREPARATION

A. Before proceeding with work, verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with landscape work.
   1. Plant totals are for convenience of Contractor only and are not guaranteed. Verify amounts shown on Drawings.
   2. All planting indicated on Contract Documents is required unless indicated otherwise.

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.

3.4 INSTALLATION

A. Interface With Other Work:
   1. Do not plant trees and shrubs until major construction operations are completed. Do not commence landscaping work until work of Section 31 2216 and Section 32 8423 has been completed and approved.

B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

C. Hand excavate as required.

D. Maintain grade stakes until parties concerned mutually agree upon removal.

E. When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify Architect before planting.

3.5 FIELD QUALITY CONTROL

A. Field Inspection:
   1. Architect will inspect landscaping installation approximately two (2) weeks before Substantial Completion.

B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Replace landscaping that is dead or appears dead as directed by Architect within ten (10) days of notification and before Substantial Completion at no additional cost to Owner.
   2. Replace damaged plantings at no additional cost to Owner.
   3. Repair damage to irrigation, ground lighting, utilities, asphalt paving, concrete paving, concrete sidewalks, concrete curb and gutters and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

3.6 CLEANING

A. Waste Management:
   1. Immediately clean up soil or debris spilled onto pavement and dispose of deleterious materials.

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 Architect has accepted planted areas.

3.8 MAINTENANCE

A. General:
   1. Before beginning maintenance period, plants shall be in at least as sound, healthy, vigorous, and in approved condition as when delivered to site, unless accepted by Architect in writing at final landscape inspection.
   2. Maintain landscaping for thirty (30) days minimum after Substantial Completion Meeting. Areas sodded or seeded after November 1st will accepted following spring approximately one (1) month after start of growing season, May 1st or as determined by Architect, if specified conditions have been met.
   3. Replace landscaping that is dead or appears unhealthy or non-vigorous as directed by Architect before end of maintenance period. Make replacements within ten (10) days of notification. Lawn being replaced shall be guaranteed and maintained an additional thirty (30) days from date of replacement.

B. Seeded Lawn:
   1. Seeded lawn areas will not be accepted as complete and thirty (30) day maintenance period will not begin until uniform stand of grass at least 3 inches (75 mm) tall has been obtained.
   2. After grass is established and 3 inches (75 mm) tall, mow lawn areas at least weekly to a height of 2 inches (50 mm). During this period, perform work necessary to maintain a full, even stand of grass.
   3. At end of thirty (30) days of maintenance period, fertilize lawns as specified in Section 32 9113.
   4. Apply weed killers as necessary in order to obtain weed free lawn. Apply weed killer in accordance with manufacturer's instructions during calm weather when air temperature is between 50 and 80 deg F (10 and 27 deg C).

C. Sodded Lawn:
   1. Maintain sodded lawn areas until lawn complies with specified requirements and throughout maintenance period.
   2. Water sodded areas in sufficient quantities and at required frequency to maintain sub-soil immediately under sod continuously moist 3 to 4 inches (75 to 100 mm) deep.
   3. Cut grass first time when it reaches 3 inches (75 mm) high. Continue to mow at least once each week throughout maintenance period. Remove clippings.
   4. Apply weed killer as necessary to maintain weed-free lawn. Apply weed killer in accordance with manufacturer's instructions during calm weather when air temperature is between 50 and 80 deg F (10 and 27 deg C).
   5. At end of thirty (30) day maintenance period, fertilize lawns as recommended in Section 32 9113.

D. Trees, Shrubs, And Plants:
   1. Maintain by pruning, cultivating, and weeding as required for healthy growth.
   2. Restore planting basins.
   3. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical positions as required.
   4. Spray as required to keep trees and shrubs free of insects and disease.
   5. Provide supplemental water by hand as needed in addition to water from sprinkling system.

END OF SECTION

SECTION 32 9120

TOPSOIL AND PLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil evaluation and placement required prior to topsoil grading as described in Contract Documents.

B. Related Requirements:
   1. Section 32 9001: 'Common Landscape Requirements'
      a. Pre-installation conference held jointly with other common planting related sections.
   2. Section 32 9122: 'Topsoil Grading' for preparation of topsoil and addition of amendments prior to landscaping.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM D1557-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.
   2. In addition to agenda items specified in Section 32 9001, review the following:
      a. Review finish grade elevation and tolerance requirements.
      b. Review surface preparation requirements including disking, tilling, ripping, or aerating.
      c. Review test requirements as per Attachment 'Topsoil Testing Report' in this specification

1.4 SUBMITTALS

A. Informational Submittals:
   1. Field Quality Control Submittals:
      a. Submit tests on imported and site topsoil by licensed laboratory before use, using Owner Form 'Topsoil Testing Report':
         1) Topsoil shall meet minimum specified physical requirements and be approved by Landscape Architect.
         2) If in-place topsoil does not comply, enhance and test until installed topsoil complies with Project Specifications.
         3) If necessary, submit proposed amendments and application rates necessary to bring topsoil up to minimum specified requirements.
      b. Submit report stating location of source of imported topsoil and account of recent use.
   2. Installer Reports:
      a. Delivery slips indicating amount of physical amendments delivered to Project site.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:

a. Record Documentation:
   1) 'Topsoil Testing Report'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. Design Criteria:
      a. Topsoil used in landscaped areas, whether imported, stockpiled, or in place, shall be weed free, fertile, loose, friable soil meeting following criteria:
         1) Chemical Characteristics:
            a) pH 5.5 to 8.0.
            b) Soluble Salts: less than 3.0 mmhos/cm.
            c) Sodium Absorption Ratio (SAR): less than 6.0.
            d) Organic Matter: greater than one percent.
         2) Physical Characteristics:
            a) Gradation as defined by USDA triangle of physical characteristics as measured by hydrometer.
               (1) Sand: 15 to 60 percent.
               (2) Silt: 10 to 60 percent.
               (3) Clay: 5 to 30 percent.
            b) Clean and free from toxic minerals and chemicals, noxious weeds, rocks larger than or equal to 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
            c) Soil (Coordinate screening as specified in Section 31 1413 'Topsoil Stripping And Stockpiling' to meet these characteristics):
               (1) Soil shall not contain more than five (5) percent by volume of rocks measuring over 1/4 inch (6 mm) in largest size.
               (2) Soil shall be topsoil in nature.
               (3) Soil resembling road base or other like materials are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Do not commence work of this Section until grading tolerances specified in Section 31 2216 are met.
   2. Do not commence work of this Section until coordination with Section 32 9121 'Physical Preparation' and Section 32 9122 'Topsoil Grading' and if required by these specifications prior to placement.
   3. Receive approval from Landscape Architect of subgrade elevations prior to commencement of this Work.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Protect utilities and site elements from damage.

B. Surface Preparation:
   1. Surfaces to receive Imported and Stockpiled Topsoil:
      a. Disk, till, rip, or aerate with approved agricultural aerator to depth of 6 inches (150 mm).
      b. Place specified and approved topsoil on prepared surface.

3.3 PERFORMANCE

A. General:
   1. After Surface Preparation requirements are completed, limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
   2. Do not expose or damage existing shrub or tree roots.

B. Topsoil Depth/Quantity:
   1. Total topsoil depth of 5 inches (125 mm) minimum in lawn and groundcover planting areas.
   2. No topsoil as defined in this Section is required over tree and shrub planting areas or native grass, shrub, or tree areas as long as what is in place is not excessively rocky or otherwise unfavorable to healthy plant growth.
   3. Provide no less than quantity required to achieve tolerance described in Section 32 9122 'Topsoil Grading' along with additional soil amendments required in Section 32 9121 'Topsoil Physical Preparation' and in Section 32 9122 ‘Topsoil Grading’. Installer of this section responsible for providing sufficient topsoil material.

C. Imported Topsoil:
   1. Place tested and approved topsoil:
      a. Before placing topsoil, remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.
      b. Do not place topsoil whose moisture content makes it prone to compaction during placement process.
      c. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

D. In Place Topsoil:
   1. At locations where topsoil can remain in place and has been tested and approved, perform the following:
      a. Remove existing vegetation as required in preparation for new landscaping.
      b. Remove vegetative layer, roots, organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

E. Grading:
   1. Slope grade away from building for 12 feet (3.60 m) minimum from walls at slope of 1/2 inch in 12 inches (13 mm in 300 mm) minimum unless otherwise noted.
      a. High point of finish grade at building foundation shall be 6 inches (150 mm) minimum below finish floor level.
      b. Direct surface drainage in manner indicated on Contract Documents by molding surface to facilitate natural run-off of water.
      c. Fill low spots and pockets with topsoil and grade to drain properly.

3.4 FIELD QUALITY CONTROL

A. Testing And Inspections:
   1. Topsoil Testing:
      a. Test topsoil for project suitability using Owner supplied ‘Topsoil Testing Report,’ attachment to this specification:
         1) Testing requirements:
            a) If testing report shows topsoil does not meet topsoil Design Criteria and ‘Topsoil Testing Report: Soil Test Data’ requirements, topsoil is non-conforming. Corrections and re-testing are required until topsoil meets requirements.
            b) Use new ‘Topsoil Testing Report’, each time topsoil is tested.
            c) After topsoil testing is approved by Landscape Architect, submit two (2) copies of Final ‘Topsoil Testing Report as specified in Part 1 ‘Submittals’ of this specification.

B. Non-Conforming Work:
   1. If topsoil does not meet topsoil Design Criteria and ‘Topsoil Testing Report: Soil Test Data’ requirements topsoil will be re-tested at no cost to Owner.

a. Correction procedures:
    1) Topsoil not meeting specified physical characteristics of sand, silt, and clay shall be removed from site.
    2) Topsoil not meeting specified organic or fertility specifications may be amended in place with materials recommended in Topsoil Testing Report.
    3) If amendments are necessary, submit proposed amendments and application rates required to bring topsoil up to minimum specified requirements.
    4) Re-test topsoil and remove and amend as required until it meets minimum specified requirements.
b. Submit report to Landscape Architect for approval.
c. Receive approval from Landscape Architect prior to planting.

END OF SECTION

ATTACHMENTS

Topsoil Testing Report

Project	Name		Property Number
	Site Street Address, City, State/Province		
Person Submitting Test	Name	Date Requested	Phone
	Address, City, State/Province		Fax
Soil Testing Laboratory	Name	Date Submitted	Phone
	Address, City, State/Province		Fax

General

1. Owner will pay for pre-bid testing and one (1) final topsoil test.

Landscape Architect Instructions

1. Landscape Architect shall determine by investigation quality and quantity of topsoil on site before landscape design. Add physical and fertility recommendations from laboratory recommendations to relevant Church specifications.

Contractor Instructions

1. Test installed topsoil. Installed topsoil shall comply with Project Specifications.
2. If installed topsoil does not comply, Contractor will enhance and test at no cost to Owner until installed topsoil complies with Project Specifications.

Testing Instructions

1. Collect at least two (2) samples of on-site topsoil and each anticipated topsoil source. If site soil profile or borrow pit are not uniform, additional samples shall be taken. Uniform composite samples may also be used if properly acquired and documented.
2. Submit required soil samples to soil testing laboratory along with all required (for this report and laboratory) information.

Soil Testing Laboratory Instructions

1. This report must be completely filled out and provide soil interpretation and amendment, fertilizer, and soil conditioner recommendations for use by Landscape Architect. These recommendations should consider lawn areas, tree and shrub areas, and native plant areas.
2. Provide appropriate times for fertilizing.
3. Return completed Topsoil Testing Report to person submitting the test.

SOIL SAMPLE LOG		
Soil Sample No.	Description of location where sample was taken	History of use of the soil

Existing Conditions Test Report ("Acceptable Levels" refers to the allowable soil specifications prior to being amended)

SOIL TEST DATA												
Sample No.	pH(1)	EC(1) Mmhos/cm	SAR(1)	% Sand	% Silt	% Clay	Text(2) Class	%(3) OM	NO3-N(4) ppm	P(5) ppm	K(5) ppm	Fe(5) Ppm
Acceptable	5.5 - 8.4	<3.0	<6.0	15-60	10-60	5-30	(2)	>1.0	>20	>11	>130	>10

Level(s)												

(1) Saturated soil paste 1:1 soil:water method (please Indicate)

(2)Hydrometer method (Acceptable soil- sand:15-60 percent, silt:10-60 percent, clay-5-30 percent)

(3)Potassium dichromate method (Walkey-Black) or loss of ignition

(4)Chromotropic acid method

(5)AB-DTPA method

If other methods are used for NO3-N, P, K, and Fe, then note.

ROCKS (Coarse Fragments)		
Sample No.	Percent > 1/4 inch (6.4 mm)	Rocks Present ≥ 1.5 inch (38 mm) Indicate as present or not present
	percent	
	percent	
Acceptable Level	≤ 5.0 percent	< 1.5 inch (38 mm)

Landscape Area Description

Lawn Areas: Receive 5 inch (125 mm) topsoil plus recommended amendments and fertilizers.

Shrub/Tree Areas: Unless otherwise indicated, plant pits are to be backfilled with three (3) parts native soil and one part compost or other recommended amendments. Additionally, contractor will add recommended fertilizer.

Native Grass/Shrub/Tree Areas: Planting to receive minimum recommended amendments and fertilizers for establishment.

INFILTRATION RATE	
Documented Infiltration rate of test sample(s) based on texture at 90 percent relative density (to nearest 1/10th of an inch)	
Sample No.	Rate
	Inches/Hour
	Inches/Hour

Interpretation Summary of Test Results:

Soil Amendments, Fertilizer and Soil Conditioner – Recommendations:

Lawn Areas

Shrub/Tree Areas

Native Grass/Shrub/Tree Areas

Long Term (5 Year) Fertilizer and Soil Conditioner – Recommendations:

Lawn Areas

Shrub/Tree Areas

Native Grass/Shrub/Tree Areas

SECTION 32 9122

TOPSOIL GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform topsoil grading required to prepare site for installation of landscaping as described in Contract Documents.
   2. Perform topsoil placement and finish grading work required to prepare site for installation of landscaping as described in Contract Documents.
   3. Furnish and apply soil amendments as described in Contract Documents.

B. Related Requirements:
   1. Section 32 9001: 'Common Planting Requirements':
      a. Pre-installation conference held jointly with other common planting related sections.
   2. Section 32 9120: ‘Topsoil And Placement’ for topsoil evaluation and placement required for topsoil grading.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.
   2. Review the following:
      a. Review soil fertility amendments and fertilizer requirements as per Attachment 'Topsoil Testing Report' in Section 32 9120.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Soil Fertility Amendments and Fertilizer:
         1) Product literature and chemical / nutrient analysis of soil amendments and fertilizers.
   2. Samples:
      a. Soil Fertility Amendments and Fertilizer:
         1) Sample of soil conditioner for approval before delivery to site.
         2) Include product analysis list.

B. Informational Submittals:
   1. Field Quality Control Submittals:
      a. Soil Fertility Amendments and Fertilizer:
         1) Submit proposed amendments and application rates necessary to bring topsoil up to minimum specified requirements.
         2) Submit report stating location of source of imported topsoil and account of recent use.
         3) Submit report to verify compost meets Ideal or Acceptable requirements.
   2. Installer Reports:
      a. Soil Fertility Amendments and Fertilizer:
         1) Delivery slips indicating amount of soil amendments, compost, conditioner, and fertilizer delivered to Project site.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual:
      a. Record Documentation:

1) ‘Compost Verification Report’.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil Amendments:
1. If required, incorporate following soil amendments into topsoil used for Project:
a. Acceptable Soil Amendments, Soil Conditioners, And Application Rates. (Choose one):
1) 'Soil Pep': Application Rate from Topsoil Testing Report.
2) ‘Compost’: Rate from Topsoil Testing Report.
3) Other amendments and conditioners as specified by topsoil Testing Report, such as lime, gypsum, Axis, etc.
4) Equals as approved by Architect before use.
b. Acceptable Fertilizers And Application Rates:
1) Apply Fertilizer and Application Rates from Topsoil Testing Report.
2) Equal as approved by Architect before installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Do not commence work of this Section until imported, stockpiled and in place topsoil are placed as specified in Section 32 9120 'Topsoil And Placement'.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
1. Protect utilities and site elements from damage.

B. Surface Preparation:
1. Surfaces that meet specified topsoil elevations.
a. Seven (7) days maximum before beginning seeding and planting:
1) Loosen topsoil 6 inch (150 mm) deep, dampen thoroughly, and cultivate to properly break up clods and lumps.
2) Rake area to remove clods, rocks, weeds, roots, debris or other material 1-1/2 inches (38 mm) or more in any dimension.
3) Grade and shape landscape area to bring surface to true uniform planes free from irregularities and to provide drainage and proper slope to catch basins.
2. Addition of Soil Amendments:
a. Add specified soil amendments at specified rates to topsoil as directed by Topsoil Testing Report found in Section 32 9120 'Topsoil And Placement'.
b. Add specified fertilizers at specified rates into topsoil as directed by Soil Testing Laboratory.
c. Roto-till or otherwise mix soil amendments evenly into topsoil.
d. 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.

3.3 PERFORMANCE

A. General:

1. Limit use of heavy equipment to areas no closer than 6 feet (1.80 meter) from building or other permanent structures. Use hand held tillers for preparation of subsoil in areas closer than 6 feet (1.80 m).
2. Do not expose or damage existing shrub or tree roots.

B. Finish Grade Tolerances (As shown on General Planting Details in Contract Documents):
   1. Finish topsoil grade of planting areas before planting and after addition of soil additives shall be specified distances below top of adjacent pavement of any kind:
      a. Ground Cover Areas: 2 inches (50 mm) below.
      b. Seeded Areas: One inch (25 mm) below.
      c. Sodded Areas: 2 inches (50 mm) below.
      d. Tree and Shrub Areas (not individual trees): 4 inches (100 mm) below.

C. Placed Topsoil:
   1. At locations where topsoil has been placed as per Section 32 9120 'Topsoil and Placement', perform the following:
      a. Remove existing vegetation as required in preparation for new landscaping.
      b. Remove organic material, rocks and clods greater than 1-1/2 inch (38 mm) in any dimension, and other objectionable materials.

D. Grading:
   1. Coordinate grading as described in Section 32 9120 'Topsoil and Placement'.

E. Immediately before planting lawn and with topsoil in semi-dry condition, roll areas that are to receive lawn in two directions at approximately right angles with water ballast roller weighing 100 to 300 lbs (45 to 135 kg), depending on soil type.

F. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

3.4 PROTECTION

A. After landscape areas have been prepared, take no heavy objects over them except lawn rollers.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Sodding.
   3. Hydroseeding.
   4. Native grasses and wildflowers.
   5. No Mow grass.

1.02 RELATED SECTIONS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 31 10 00 - Site Clearing: for topsoil stripping and stockpiling.

F. Section 31 23 00 - Excavation and Fill: for excavation, filling and backfilling, and rough grading.

G. Section 32 84 00 - Planting Irrigation: for turf irrigation.

H. Section 32 93 00 - Plants: for border edgings.

1.03 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), mammals (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile,and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.04 REFERENCE STANDARDS

A. AOSA RULES - Rules for Testing Seeds; 2024.

B. ASTM C602 - Standard Specification for Agricultural Liming Materials; 2023.

C. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping and Construction Purposes; 2023.

D. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding; 2006.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.06 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture:
      a. Turfgrass sod.
      b. Native grass seed mix.
      c. No Mow seed Mix.
      d. Include identification of source and name and telephone number of supplier.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For soil amendments and fertilizers, from manufacturer.

D. Material Test Reports: For imported or manufactured topsoil per Section 31 23 00 - Excavation and Fill.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and seeded areas during a calendar year. Submit before expiration of required initial maintenance periods.

1.07 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and native seeding meadow establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience Five years' experience in turf installation in addition to requirements in Section 01 40 00 - Quality Requirements.
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification from the Professional Landcare Network as a certified landscape technician – exterior with installation and maintenance specialty areas designated CLT-Exterior and one of the following:
      a. Certified Turfgrass Professional, designated CTP.
      b. Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.
   5. Pesticide Applicator: State licensed, commercial.

C. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Soil Analysis: **Will be by the local University or qualified testing facility** and available for each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
   a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
   b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

E. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI (SPEC) "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.09 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

B. Sod:
   1. Spring Planting: As specified on drawings.
   2. Fall Planting: As specified on drawings.

C. Native Seed:
   1. Spring Planting: As specified on drawings.
   2. Fall Planting: As specified on drawings.

D. No Mow Seed:
   1. Spring Planting: As specified on drawings.
   2. Fall Planting: As specified on drawings.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.10 ESTABLISHMENT SERVICES

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 4. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following period:
   1. Sodded Turf:

a. 2 calendar years.

B. Initial Native Seed Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 4. Begin maintenance immediately after each area is planted and continue until acceptable native seed is established, but for not less than the following period:
   1. 90 Days.
   2. 2 growing seasons. (as defined by Landscape Architect for project location)
   3. 2 calendar years.

C. Continuing Long Term Maintenance Proposal: May be requested from the Owner to have the Installer provide, 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

2.01 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA RULES "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as follows:

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
   1. Full Sun: Bermudagrass (Cynodon dactylon).
   2. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
   3. Sun and Partial Shade: Proportioned by weight as follows:
      a. 50 percent Kentucky bluegrass (Poa pratensis).
      b. 30 percent chewings red fescue (Festuca rubra variety).
      c. 10 percent perennial ryegrass (Lolium perenne).
      d. 10 percent redtop (Agrostis alba).
   4. Shade: Proportioned by weight as follows:
      a. 50 percent chewings red fescue (Festuca rubra variety).
      b. 35 percent rough bluegrass (Poa trivialis).
      c. 15 percent redtop (Agrostis alba).

2.02 TURFGRASS SOD

A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Bermudagrass (Cynodon dactylon), Carpetgrass (Axonopus affinis), Centipedegrass (Eremochloa ophiuroides), St. Augustinegrass (Stenotaphrum secundatum), Zoysiagrass (Zoysia japonica), Zoysiagrass (Zoysia matrella).

C. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
   1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
   2. Sun and Partial Shade: Proportioned by weight as follows:
      a. 50 percent Kentucky bluegrass (Poa pratensis).
      b. 30 percent chewings red fescue (Festuca rubra variety).
      c. 10 percent perennial ryegrass (Lolium perenne).
      d. 10 percent redtop (Agrostis alba).
   3. Shade: Proportioned by weight as follows:
      a. 50 percent chewings red fescue (Festuca rubra variety).
      b. 35 percent rough bluegrass (Poa trivialis).
      c. 15 percent redtop (Agrostis alba).

2.03 MEADOW GRASSES AND WILDFLOWERS

A. Wildflower Seed: Fresh, clean, and dry new seed, of mixed species as follows:
   1. As illustrated on the drawings.

B. Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:
   1. As illustrated on the drawings.

C. Wildflower and Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:
   1. As illustrated on the drawings.

2.04 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent.

B. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

C. Perlite: Horticultural perlite, soil amendment grade.

D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

E. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

F. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.05 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 7.5; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 to 60 percent of dry weight.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

2.06 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
   2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
   2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.07 PLANTING SOILS

A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix topsoil with the soil amendments and fertilizers as indicated in the testing reports.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   1. Supplement with another specified planting soil when quantities are insufficient.
   2. Mix existing, native surface topsoil with the following soil amendments and fertilizers as indicated in the soil testing reports.

C. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.
   1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
   2. Mix imported topsoil or manufactured topsoil with the soil amendments and fetilizers to produce planting suitable soil as directed by the soil testing agencies.

D. Lightweight On-Structure Planting Soil: Soils provided by premanufactured blends suitable for on structure planting. See architectural drawings for specified soil composition and manufacturer.

2.08 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.09 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.10 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply fertilizer directly to subgrade before loosening.
   2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.
   3. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
      a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
      b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
      a. Apply fertilizer directly to surface soil before loosening.
   3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
   4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.05 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   1. Do not use wet seed or seed that is moldy or otherwise damaged.
   2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
   1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
   2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch and roll surface smooth.

3.06 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Native seed mixtures shall not be hydroseeded and hydromulched together. If necessary tackifiers can be applied by hydromulch, separately, following separate mechanical or hydroseedng as described above.

3.07 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across angle of slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.08 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
   1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
   2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.09 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
   3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
   1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow bentgrass to a height of 1/2 inch or less.
   2. Mow bermudagrass to a height of 1/2 to 1 inch.
   3. Mow carpetgrass, centipedegrass, perennial ryegrass, zoysiagrass to a height of 1 to 2 inches.
   4. Mow Kentucky bluegrass, buffalograss, annual ryegrass, chewings red fescue to a height of 1-1/2 to 2 inches.
   5. Mow bahiagrass, turf-type tall fescue, St. Augustinegrass to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
   1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.10 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:
   1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
   2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
   3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
   4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.11 MEADOW

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate of 5 oz./1000 sq. ft.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch and roll surface smooth.

E. Water newly planted areas and keep moist until meadow is established.

3.12 MEADOW MAINTENANCE

A. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water meadow with fine spray at a minimum rate of 1/2 inch per week for six weeks after planting unless rainfall precipitation is adequate.

3.13 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.14 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

3.15 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

3.16 DURATION OF MAINTENANCE

A. Maintenance of Turf and Grasses shall continue until Owner accepts that the processes listed above have been completed.

PART 4 TURF AND GRASS ESTABLISHMENT PERIOD

4.01 ESTABLISHMENT PERIOD

A. Plant Establishment Period (PEP) begins on the date that initial planting operations (Substantial Completion) on the project are completed and continues until final acceptance of the project, and will last for the following period:
1. 2 calendar years.

4.02 ESTABLISHMENT WORK

A. Keep turf and grasses in a healthy growing condition in accordance with the Landscape Standards throughout the establishment period and submit Life Time Landscape Contractor Inspection Reports. Perform turf and grass establishment work throughout the growing seasons and as necessary during the dormant seasons (as defined by Landscape Architect). The Landscape Architect may perform inspections throughout the PEP to verify compliance. The Landscape Architect will consider the Contractor non-compliant if the Contractor does not maintain turf and grasses throughout the PEP and does not submit Inspection reports.

B. All Turf and Grasses:
1. In Turf and Grass establishment work, perform the following:
2. Inspect to assess the condition of the turf and grasses and the site and factors that may influence turf and grass health, vigor, and establishment success. Inspect these conditions at

least every two weeks during the growing season and at least every month during the dormant season;

3. Submit a written Inspection report to the Landscape Architect via e-mail by the 1st and 15th of each month during the growing season and by the 1st of each month during the dormant season. The Landscape Architect will use the report-frequency and content to assess plant establishment compliance. The report may include scanned copies of the plan sheets with the Contractor notes, copies of the report form found in the Life Time Landscape Standards Manual. Include the following in the report:
    a. The project number;
    b. Engineer's name;
    c. Name of Contractor's responsible scout or representative;
    d. Dates work was performed;
    e. Work locations;
    f. Work completed;
    g. Prevailing weather conditions;
    h. Soil moisture assessments;
    i. Insect, animal, vehicular, weather, or other damage;
    j. Disease problems;
    k. Treatment recommendations' and
    l. Assessment of overall plant conditions including weed competition and control.
4. Maintain soil moisture in accordance with the watering guidelines of the standard planting details shown on the plans.
5. Maintain healthy, vigorous turf and grass. free of harmful insects, fungus, and disease.
6. Repair dead, dying, and unsightly turf and grass. Provide and install replacement turf and grass in accordance with Replacement Requirements and according to Construction Drawings and Specifications.
7. Maintain turf and grass areas in a weed-free condition as follows:
    a. Remove weeds, top growth and roots, within the turf and grass limits.
    b. Do not spray chemicals for weed control in mulched planting areas during the PEP. The Contractor may apply a non-selective, non-residual post-emergent herbicide containing 41 percent glyphosate, as the active ingredient with a surfactant on a spot treatment basis with a brush or wick applicator. The Contractor may also apply a broad-spectrum dichlobenil based granular, pre-emergent herbicide in accordance with product labeling and manufacturer's recommendations;
    c. Do not weed whip or weed clip as weed control.
8. Prevent or repair rutting and other damage that may lead to soil erosion and weed infestation.
9. Perform turf and grass establishment operations consistent with plant care and horticultural practices detailed in the Life Time Landscape Standards.
10. Remove excess material, obsolete temporary erosion control devices, rocks, and debris from the project.

C. Replacement requirements:
    1. Within the first half of the PEP, determine which turf and grass need replacing. Replace dead, defective turf and grass and incidental materials in accordance with initial installation requirements, including turf and grass lost due to accidents, vandalism, theft, rodent and pest damage, damage caused by the Contractor, or if ordered by the Landscape Architect or Facilities Manager, at no additional cost to the Owner. Conduct turf and grass replacement operations as needed within the first half of the PEP. At least one week before turf and grass replacement, submit a summary report of proposed turf and grass replacements to the Landscape Architect and Facilities Manager. Include by attachment, copies of plan sheets with the proposed replacement quantities and locations identified and a Life Time Certificate of Compliance for Turf and Grass, Landscape Material, and Equipment, in the report. Using brightly colored paint, mark on site turf and grass requiring replacement. Provide replacement turf and grass and incidental materials that are equal to and the same as the initial material required by the contract.

D. Final Acceptance:

a. As a condition for terminating the PEP and conducting the final inspection, the Landscape Architect and Facility Manager may require the Contractor to bring the turf and grass establishment work into compliance. At the end of the PEP, the Landscape Architect and Facility Manager along with the Establishment Contractor will perform a final inspection of the project.

E. Transition to Long Term Maintenance:

1. Upon final acceptance, the project will transition from Establishment Contractor care of turf and grass to Long Term Maintenance. A coordination meeting to transition from the Establishment Contractor to Long-Term Maintenance Contractor will take place one week prior to conclusion of the Establishment period to ensure all requirements are met and the Long-Term Contractor understands their role and when they will take over Maintenance.

END OF SECTION

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SECTION 32 9223

SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sodded lawn as described in Contract Documents.

B. Related Requirements:
   1. Section 32 8423: Irrigation system.
   2. Section 32 9001: Common Landscape Requirements:
      a. Pre-installation conference held jointly with other common planting related sections.
   3. Section 32 9120: 'Topsoil and Placement'.
   4. Section 32 9122: 'Topsoil Grading'

1.2 REFERENCES

A. Definitions:
   1. Crop Coefficients and Hydro-Zones: Crop coefficients (Kc) are used with ETo to estimate specific plant evapotranspiration rates. The crop coefficient is a dimensionless number (between 0 and 1.2) that is multiplied by the ETo value to arrive at a plant ET (ETc) estimate. Plants grouped by water needs, organized into one irrigation zone.
   2. Eco-Region Irrigation Design: A bio-regional approach to irrigation and planting design that is relevant to the geographic area for which the planting plan and irrigation system is designed.
   3. Hardiness Zone: A hardiness zone is a more precisely geographically-defined zone within an Eco-Region in which a specific category of plant life is capable of growing, as defined by temperature hardiness, or ability to withstand the minimum temperatures of the zone. Hardiness Zones may be defined by one of two sources:
      a. Sunset Western Garden Book Maps.
      b. USDA Hardiness Zone Map.

      Plant Hardiness zone sources shall be listed by the architect through the planting and irrigation design process.
   4. Hydro-Zone: Plants grouped by water needs (similar Crop Coefficients (Kc), organized into one irrigation zone.
   5. Reference Evapotranspriation (ETo): The total water lost from the soil (evaporation) and from the plant surface (transpiration) over some period.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.

1.4 SUBMITTALS

A. Informational Submittals:
   1. Source Quality Control Submittals:
      a. Written certification confirming lawn seed quality and mix.

B. Closeout Submittals:

1. Include following in Operations And Maintenance Manual:
    a. Maintenance Contracts:
        1) See Site Management Plan (SMP) for Establishment Period Maintenance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Harvest, deliver, store, and handle sod in accordance with requirements of Turfgrass Producers International (TPI) (formally American Sod Producers Association) Specifications for Turfgrass Sod Materials and Transplanting / Installing.
2. Schedule deliveries to coincide with topsoil operations and laying. Keep storage at job site to minimum without causing delays.
    a. Deliver, unload, and store sod on pallets within 24 hours of being lifted.
    b. Do not deliver small, irregular, or broken pieces of sod.

B. Storage And Handling Requirements:
1. Cut sod in pieces approximately 3/4 to one inch (19 to 25 mm) thick. Roll or fold sod so it may be lifted and handled without breaking or tearing and without loss of soil.
2. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
3. During dry weather, protect sod from drying before installation. Water as necessary to insure vitality and to prevent excess loss of soil in handling. Sod that dries out before installation will be rejected.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description:
1. Superior sod grown from certified, high quality, seed of known origin or from plantings of certified grass seedlings or stolons:
    a. Assure satisfactory genetic identity and purity.
    b. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.
2. Sod shall be as specified on the planting plans within the landscape schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work:
1. Do not commence work of this Section until work of Sections 32 9122 and 32 9300 has been completed and approved.

B. Tolerances:
1. Final grade of soil after sodding of lawn areas is complete shall be one inch (25 mm below top of adjacent pavement of any kind.

C. Laying of Sod:
1. Lay sod during growing season and within 48 hours of being lifted.
2. Lay sod while top 6 inches (150 mm) of soil is damp, but not muddy. Sodding during freezing temperatures or over frozen soil is not acceptable.

3. Lay sod in rows perpendicular to slope with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.
4. Lay sod flush with adjoining existing sodded surfaces.
5. Do not sod slopes steeper than 3:1. Consult with Architect for alternate treatment.

D. After Laying of Sod Is Complete:
1. Roll horizontal surface areas in two directions perpendicular to each other.
2. Repair and re-roll areas with depressions, lumps, or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.
3. Water sodded areas immediately after laying sod to obtain moisture penetration through sod into top 6 inches (150 mm) of topsoil.

3.2 FIELD QUALITY CONTROL

A. Field Inspection:
1. Sodded areas will be accepted at Project closeout if:
a. Sodded areas are properly established.
b. Sod is free of bare and dead spots and is without weeds.
c. No surface soil is visible when grass has been cut to height of 2 inches (50 mm).
2. Sodded areas have been mowed a minimum of twice.

END OF SECTION

SECTION 32 93 00
PLANTS

PART 1 GENERAL

2.01 DESCRIPTION

A. This work consists of providing, planting, and establishing trees, shrubs, vines, and perennials of the species, variety, grade, size, or age, and root category specified for the locations shown on the plans.

2.02 SUMMARY

A. Section Includes:
   1. Plants.
   2. Planting soils.
   3. Tree stabilization.
   4. Landscape edgings.
   5. Tree grates.

2.03 RELATED SECTIONS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 01 33 00 - Submittal Procedures

C. Section 01 40 00 - Quality Requirements

D. Section 01 60 00 - Product Requirements

E. Section 31 10 00 - Site Clearing: for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.

F. Section 31 23 00 - Excavation and Fill: for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

G. Section 32 33 00 - Site Furnishings: for exterior unit planters.

H. Section 32 92 00 - Turf and Grasses: for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

2.04 REFERENCE STANDARDS

A. ANSI/AHIA Z60.2 - American Standard for Nursery Stock; 2025.

B. ASME B18.6.1 - Wood Screws; 2016.

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM C602 - Standard Specification for Agricultural Liming Materials; 2023.

G. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping and Construction Purposes; 2023.

H. USDA Handbook no. 60 - Diagnosis and Improvement of Saline and Alkali Soils; Current Edition.

2.05 UNIT PRICES

A. Provide Unit prices as follows:
   1. Unit prices apply to authorized work covered by quantity allowances.
   2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

2.06 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI/AHIA Z60.2 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI/AHIA Z60.2.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI/AHIA Z60.2 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI/AHIA Z60.2 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI/AHIA Z60.2 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI/AHIA Z60.2 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), mammals (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

R. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

2.07 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

3. Plant Photographs: Include color photographs in digital 3- by 5-inch format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:
   1. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
   2. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
   3. Weed Control Barrier: 12 by 12 inches.
   4. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
   5. Tree Grates and Accessories: Manufacturer's standard size delivered to the site for review, to verify design and color selected.
   6. Root Barrier: Width of panel by 12 inches.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

2.08 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of five(5) similar projects completed by Installer in last three years, demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include references from owner and names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Material Test Reports: For standardized ASTM D5268A topsoil, existing native surface topsoil and imported or manufactured topsoil.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Request Landscape Standards Document for Establishment before start of required Establishment periods.

E. Warranty: Two-year warranty on all plants and materials from substantial completion.

2.09 QUALITY ASSURANCE

A. Manufacturers and Installers shall satisfy minimum qualifications listed in Section 01 40 00 in addition to the requirements below.

B. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' minimum experience in landscape installation in addition to requirements in Section 01 40 00 "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor or personnel assigned to the Work shall have certification from the Professional Landcare Network as a Certified Landscape Technician - Exterior, with installation, maintenance, irrigation specialty area(s), designated CLT-Exterior.
5. Pesticide Applicator: State licensed, commercial.

C. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
1. Testing methods and written recommendations shall comply with USDA Handbook no. 60.
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.
    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

E. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI/AHIA Z60.2.
1. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

F. Measurements: Measure according to ANSI/AHIA Z60.2. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

G. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials one week in advance of delivery to site and provide the Landscape Architect with the following:
    a. A copy of a valid nursery stock, dealer or grower certificate, registered with the State Department of Agriculture, a current nursery certificate or license from a state or provincial Department of Agriculture for each plant stock supplier, or both;
    b. Documentation certifying that plant material shipped from out-of-state nursery vendors subject to state and federal quarantines, is free of currently regulated pests, including Emerald Ash Borers, and Gypsy Moths. To determine if State vendors are subject to quarantines, call the State Supervisor of Nursery Inspection and Export Certification; and
    c. An updated Certificate of Compliance, signed by the Contractor’s authorized representative.

H. Preinstallation Conference: Conduct conference at the Project site with the Landscape Architect, Construction Project Manager and Landscape Contractor, job captain and key installation specialists.

2.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
   1. Upon delivery of plant stock and materials to the project, provide the Landscape Architect with the following:
      1) Bills of lading or shipping documents for plant stock and landscape materials delivered to the project, and
      2) An updated and signed Certificate of Compliance, if necessary, to reflect deviations from the original Certificate of Compliance documentation submitted at or before the preconstruction conference.
   2. As a condition for authorization of payments, provide the Landscape Architect with vendor invoices or billing statements for plant stock and materials used on the project.
   3. The Landscape Architect will consider work performed with plant stock, materials, or equipment that was misrepresented in the documentation, as unauthorized work.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
   1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.
   3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

2.11 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
   1. Notify Landscape Architect and Construction Manager no fewer than two days in advance of proposed interruption of each service or utility.
   2. Do not proceed with interruption of services or utilities without Construction Manager's written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required establishment from date of Substantial Completion. Plants

installed outside dates listed below will not be paid for or evaluated for payment until 1 full growing season has elapsed. This condition may affect final payment for work. Do not move or plant coniferous evergreen materials after bud break or during conditions of new growth.

1. Deciduous B&B and Potted Plants: April 15th to June 15th: Aug. 21 – Nov. 15
2. Coniferous Evergreen B&B and Potted Plants: April 15 to bud break; Aug 21 to Sept. 30
3. Landscape Architect to verify local planting restrictions to region.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

2.12 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
      b. Structural failures including plantings falling or blowing over.
      c. Faulty performance of tree stabilization, edgings, tree grates.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Periods from Date of Substantial Completion:
      a. Trees, Shrubs, Vines, and Ornamental Grasses: Twelve (12) months.
      b. Ground Covers, Biennials, Perennials, and Other Plants: Twelve(12) months.
      c. Annuals: Three(3) months.
   3. Include the following remedial actions as a minimum:
      a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
      b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
      c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
      d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

2.13 ESTABLISHMENT SERVICES

A. Plant Establishment Period for Trees, Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part Four. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
   1. 2 calendar years.

B. Continuing Long Term Maintenance Proposal: May be requested from the Owner to have the Installer provide, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial Establishment service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 PRODUCTS

3.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI/AHIA Z60.2; and with healthy root systems developed by transplanting or root pruning.

Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI/AHIA Z60.2 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI/AHIA Z60.2. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

3.02 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of any of these local ground materials including dolomitic limestone, calcitic limestone, mollusk shells.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

3.03 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

3.04 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Size: 10-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

3.05 PLANTING SOILS

A. Planting Soil: ASTM D5268 topsoil, with pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D5268 topsoil with soil amendments and fertilizers in quantities, as directed by qualified soil testing lab, to produce planting soil.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil by testing. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with another specified planting soil when quantities are insufficient.
2. Mix existing, native surface topsoil with soil amendments and fertilizers in quantities, as directed by qualified soil testing lab, to produce planting soil.

C. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs, or marshes.
   1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1/2 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
   2. Mix imported topsoil or manufactured topsoil with soil amendments and fertilizers in quantities, as directed by qualified soil testing lab, to produce planting soil.

D. Lightweight On-Structure Planting Soil: Mix produced by modifying planting soil or by a custom blend to produce a lightweight soil for rooftop applications. Brand and type to be specified by the project Landscape Architect to fit planting conditions.

3.06 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Shredded hardwood mulch or approved equal used as a 3-inch top dressing in all plant beds and around trees as shown in construction details.
   2. Size Range: 3 inches maximum, 1/2 inch minimum.
   3. Color: Natural.

B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
   1. Type: Rounded riverbed gravel or smooth-faced stone, Crushed stone or gravel, Granite chips.
   2. Size Range: Varies, as specified in construction details.
   3. Color: Uniform color range acceptable to Landscape Architect.

3.07 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

3.08 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

3.09 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Stakes shall be six-foot steel “T” fencing post. Three (3) posts per tree.
2. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
3. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
4. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, Hose shall be two-ply fiber-bearing rubber garden hose, not less than ½-inch inside diameter, black or green, and of suitable length.
5. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

B. Root-Ball Stabilization Materials:
1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade, or on structure stabilization systems as specified by the Landscape Architect, to secure each new planting by root ball; sized per manufacturer's written recommendations unless otherwise indicated.

C. Palm Bracing: Battens or blocks, struts, straps, and protective padding as indicated.
1. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-4-inch nominal by lengths indicated.
2. Straps: Adjustable steel or plastic package banding straps.
3. Padding: Burlap.
4. Proprietary Palm-Bracing Devices: Proprietary systems as specified by the Landscape Architect, to secure each new planting by trunk; sized per manufacturer's written recommendations unless otherwise indicated.

3.10 LANDSCAPE EDGINGS

A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
1. 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. Edging Size: 3/16 inch wide by 5-1/2 inches deep.
3. Stakes: Aluminum, ASTM B221, Alloy 6061-T6, approximately 1-1/2 inches wide by 12 inches long.
4. Finish: Mill (natural aluminum) or Black anodized.

3.11 TREE GRATES

A. Tree Grates and Frames: ASTM A48/A48M, Class 35 or better, aluminum or gray-iron castings of shape, pattern, finish and size indicated.

3.12 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.

B. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, and each panel 18 inches to 24 inches wide.

C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

4.01 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

4.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

4.03 PLANTING AREA ESTABLISHMENT

A. Loosen subgrade of planting areas to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply fertilizer directly to subgrade before loosening.
   2. Thoroughly blend planting soil off-site before spreading.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.
   3. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
      a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate indicated on Drawings.

4.04 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
   1. Excavate approximately three times as wide as ball diameter for balled and burlapped grown stock.
   2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
   3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
   4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
   5. Maintain supervision of excavations during working hours.
   6. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
   7. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Subsoil and topsoil removed from excavations may not be used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
   1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

F. Planting Percolation Test: A minimum of two tests, per development site is required. Mark testing locations with visible stake. Prior to testing, submit site plan with proposed test locations marked for approval by Landscape Architect. Additional tests may be needed as required by Landscape Architect.
   1. Fill planting hole with water and allow it to drain completely.
   2. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into Hardpan Layer
   3. Fill planting hole with water again and immediately measure the depth of the water in the pit with a ruler. Record the time.
   4. After 15 minutes have passed, measure the depth of the water in the pit again.
   5. Multiply the number of inches that have drained by 4 to get drainage in inches per hour.
   6. Drainage will fall into one of three categories:
      a. Poorly drained = less than 2” per hour
      b. Well drained = 3” to 6” per hour
      c. Excessively drained = more than 6” per hour
   7. Prepare written test results and submit to Landscape Architect. If soils are poorly drained, immediately notify Landscape Architect of this condition. Upon direction, contractor shall install a drain stack at the bottom of the planting pit. Auger a 4” minimum diameter hole to a depth of 42” from the bottom of the plant pit and fill it with ¾” gravel. Cover the gravel with filter fabric and install plant material as directed.

4.05 TREE, SHRUB, AND VINE PLANTING

A. Install plants in accordance with the steps and requirements in the standard planting details shown on the plans and specific to each plant stock type.

B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

C. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

D. Set stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
   1. Use planting soil for backfill.
   2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
   4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
   5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

4.06 MECHANIZED TREE SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

C. Cut exposed roots cleanly during transplanting operations.

D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

4.07 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

4.08 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:
   1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of three stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.

B. Staking and Guying: Stake and guy trees more than 14 feet in height and more than 2 inches in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches long, driven to grade.

C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
   1. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

D. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.
   1. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

4.09 ROOT-BARRIER INSTALLATION

A. Install root barrier to protect paving or other hardscape elements, such as walls, curbs, and walkways as shown on Drawings.

4.10 PLANTING IN PLANTERS

A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.

B. Fill planter with lightweight planting soil as indicated on structure. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

4.11 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

4.12 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees in Turf Areas: Apply mulch ring of 3-inch average thickness, with radius around trunks or stems as shown on drawings. Do not place mulch within 3 inches of trunks or stems.
   2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

4.13 WATERING

A. During Installation, provide watering equipment and forces on the project capable of completely watering plants as often as necessary to maintain soil moisture in the root zones.

B. Within two hours of installation, saturate the backfill soil of each plant with water. After settling, provide additional backfill to fill in the voids.

4.14 EDGING INSTALLATION

A. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches apart, driven below top elevation of edging.

B. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch- deep, shovel-cut edge as shown on Drawings.

4.15 TREE GRATE INSTALLATION

A. Tree Grates: Set grate segments flush with adjoining surfaces as shown on Drawings. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- minimum growth radius around base of tree; break away units of casting, if necessary, according to manufacturer's written instructions.

4.16 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

4.17 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

4.18 RODENT PROTECTION

A. Place rodent protection around trees and other plant materials in accordance with standard planting details shown on the plans to mitigate damage.

4.19 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Repair any damaged turf areas impacted during construction.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

4.20 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

4.21 DURATION OF MAINTENANCE

A. Maintenance of Turf and Grasses shall continue until Owner accepts that the processes listed above have been completed.

PART 4 PLANT ESTABLISHMENT PERIOD

5.01 ESTABLISHMENT PERIOD

A. Plant Establishment Period (PEP) begins on the date that initial planting operations (Substantial Completion) on the project are completed and continues until final acceptance of the project, and will last for the following period:
   1. 2 calendar years.

5.02 ESTABLISHMENT WORK

A. Keep plants in a healthy growing condition in accordance with the Landscape Standards throughout the establishment period and submit Life Time Landscape Contractor Inspection Reports. Perform plant establishment work throughout the growing seasons and as necessary during the dormant seasons (As defined by Landscape Architect). The Landscape Architect may perform inspections throughout the PEP to verify compliance. The Landscape Architect will consider the Contractor non-compliant if the Contractor does not maintain plants throughout the PEP and does not submit Inspection reports.

B. In plant establishment work, perform the following:
   1. Inspect to assess the condition of the plants and the planting site and factors that may influence plant health, vigor, and establishment success. Inspect these conditions at least every two weeks during the growing season and at least every month during the dormant season;
   2. Submit a written Inspection report to the Landscape Architect via e-mail by the 1st and 15th of each month during the growing season and by the 1st of each month during the dormant season. The Landscape Architect will use the report-frequency and content to assess plant establishment compliance. The report may include scanned copies of the plan sheets with the Contractor notes, copies of the report form found in the Life Time Landscape Standards Manual. Include the following in the report:
      a. The project number;
      b. Engineer’s name;
      c. Name of Contractor’s responsible scout or representative;
      d. Dates work was performed;
      e. Work locations;
      f. Work completed;
      g. Prevailing weather conditions;
      h. Soil moisture assessments;
      i. Insect, animal, vehicular, weather, or other damage;
      j. Disease problems;
      k. Treatment recommendations;
      l. Assessment of overall plant conditions including weed competition and control.
   3. Maintain soil moisture in accordance with the watering guidelines of the standard planting details shown on the plans.
   4. Repair, adjust, or replace staking and guying, mulch material, planting soil, rodent protection, seedling tree shelters, tree paint, and other incidental items in accordance with the plans.
   5. Maintain healthy, vigorous plants. free of harmful insects, fungus, and disease;
   6. Remove dead, dying, and unsightly plants. Provide and install replacement plants in accordance with Replacement Requirements and according to Construction Drawings and Specifications;
   7. Maintain plants in a plumb condition at the planting depth shown on the planting details in the plans;
   8. Maintain planting areas in a weed-free condition as follows:
      a. Remove weeds, top growth and roots, within the mulch limits by hand pulling. Pre-water mulched areas to ensure weed top growth and roots are entirely removed. Ensure weeding operations do not contaminate the mulch or project with weed seed, weed-laden soil or propagating weed parts. Remove State and County-regulated noxious weeds to at least 5 ft [900 mm] beyond the mulch limits. Remove weed parts or weed-laden material from the project to avoid the spread of weed infestations;
      b. Do not spray chemicals for weed control in mulched planting areas during the PEP. The Contractor may apply a non-selective, non-residual post-emergent herbicide containing 41 percent glyphosate, as the active ingredient with a surfactant on a spot treatment basis with

a brush or wick applicator. The Contractor may also apply a broad-spectrum dichlobenil based granular, pre-emergent herbicide in accordance with product labeling and manufacturer's recommendations;

c. Do not weed whip or weed clip as weed control;

9. Prune to remove dead, rubbing, damaged or diseased branches, unwanted suckers, and to improve plant form and structure;
10. Prevent or repair rutting and other damage that may lead to soil erosion and weed infestation;
11. Perform plant establishment operations consistent with plant care and horticultural practices detailed in the Life Time Landscape Standards.
12. Remove excess material, obsolete temporary erosion control devices, rocks, and debris from the project.

5.03 REPLACEMENT REQUIREMENTS

A. Within the first half of the PEP, determine which plants need replacing. Replace dead, defective, or missing plants and incidental materials in accordance with initial installation requirements, including plants lost due to accidents, vandalism, theft, rodent and pest damage, damage caused by the Contractor, or if ordered by the Landscape Architect, at no additional cost to the Owner. Conduct plant replacement operations as needed within the first half of the PEP. At least one week before plant replacement, submit a summary report of proposed plant replacements to the Architect. Include by attachment, copies of plan sheets with the proposed replacement quantities and locations identified and a Life Time Certificate of Compliance for Plant Stock, Landscape Material, and Equipment, in the report. Using brightly colored paint, mark on site plants requiring replacement. Provide replacement plants and incidental materials that are equal to or better than the initial material required by the contract.

5.04 FINAL ACCEPTANCE

A. As a condition for terminating the PEP and conducting the final inspection, the Landscape Architect and Facility Manager may require the Contractor to bring the plant establishment work into compliance. At the end of the PEP, the Landscape Architect and Facility Manager along with the Establishment Contractor will perform a final inspection of the project.

5.05 TRANSITION TO LONG TERM MAINTENANCE

A. Upon final acceptance, the project will transition from Establishment Contractor care of plantings to Long Term Maintenance. A coordination meeting to transition from the Establishment Contractor to Long-Term Maintenance Contractor will take place one week prior to conclusion of the Establishment period to ensure all requirements are met and the Long-Term Contractor understands their role and when they will take over Maintenance.

END OF SECTION

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SECTION 32 9300

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install landscaping plants as described in Contract Documents.

B. Related Requirements:
   1. Section 32 8423: 'Irrigation System'
   2. Section 32 9001: 'Common Landscape Requirements'
      a. Pre-installation conference held jointly with other common planting related sections.
   3. Section 32 9120: 'Topsoil and Placement'
   4. Section 32 9121: 'Topsoil Physical Preparation' (section included based on Topsoil Testing Report)
   5. Section 32 9122: 'Topsoil Grading'

1.2 REFERENCES

A. Definitions:
   1. Crop Coefficients and Hydro-Zones: Crop coefficients (Kc) are used with ETo to estimate specific plant evapotranspiration rates. Crop coefficient is dimensionless number (between 0 and 1.2) that is multiplied by ETo value to arrive at plant ET (ETc) estimate. Plants grouped by water needs, organized into one irrigation zone.
   2. Eco-Region Irrigation Design: Bio-regional approach to irrigation and planting design that is relevant to geographic area for which planting plan and irrigation system is designed.
   3. Hardiness Zone: Hardiness zone is more precisely geographically-defined zone within an Eco-Region in which specific category of plant life is capable of growing, as defined by temperature hardiness, or ability to withstand minimum temperatures of zone. Hardiness Zones may be defined by one of two sources:
      a. Sunset Western Garden Book Maps.
      b. USDA Hardiness Zone Map.

      Plant Hardiness zone sources shall be listed by Landscape Architect through planting and irrigation design process.
   4. Hydro-Zone: Plants grouped by water needs (similar Crop Coefficients (Kc), organized into one irrigation zone.
   5. Reference Evapotranspriation (ETo): Total water lost from the soil (evaporation) and from plant surface (transpiration) over some period.

B. Reference Standards:
   1. American Nursery & Landscape Association / American National Standards Institute:
      a. ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock.'

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference as specified in Section 32 9001.

1.4 SUBMITTALS

A. Action Submittals:

1. Samples:
    a. Top dressing mulch for approval before delivery to site.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual:
    a. Maintenance Contracts:
        1) See Site Management Plan (SMP) for Establishment Period Maintenance.
    b. Operations And Maintenance Data:
        1) Installer Instructions:
            a) Provide written instructions covering maintenance requirements by Owner for one year beyond Contract maintenance period specified in Section 32 9001.
    c. Warranty Documentation:
        1) Include final, executed copy of warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
2. Do not prune before delivery, except as approved by Landscape Architect.
3. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
5. Provide protective covering during delivery.

B. Storage And Handling Requirements;
1. Handle balled stock by root ball or container. Do not drop trees and shrubs during delivery.
2. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
3. Set balled stock on ground and cover ball with soil, saw dust, or other acceptable material approved by Landscape Architect.
4. Do not remove container-grown stock from containers before time of planting.
5. Do not store plant material on pavement.
6. 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.

1.6 WARRANTY

A. Special Warranty:
1. Provide written warranties as follows:
    a. Guarantee shrubs, ground covers, and vines to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date landscape installation is accepted as complete and meet or exceed material standards set forth in Materials heading of Part 2 of this specification.
    b. Guarantee trees to live and remain in strong, vigorous, and healthy condition and meet or exceed material standards set forth in Materials heading of Part 2 of this specification for one year from date landscape installation is accepted as complete.
    c. When trees are completely accepted at end of warranty period, remove staking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plants:
1. Conform to requirements of Plant List and Key on Contract Documents and to ANLA / ANSI Z60.1.
2. Nomenclature:

a. 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 tag showing genus, species, and variety of at least 10 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 excessive root-bound conditions.
   b. Do not prune plants or top trees prior to delivery.
   c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
   d. Bare root trees are not acceptable.
   e. Provide plant materials from licensed nursery or grower.
4. Measurements:
   a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Contract Documents or Plant List.
   b. Measurement should be average of plant, not greatest diameter. For example, plant measuring 15 inches (375 mm) in widest direction and 9 inches (225 mm) in narrowest would be classified as 12 inch (300 mm) stock.
   c. Plants properly trimmed and transplanted should measure same in every direction.
   d. Measure caliper of trees 6 inches (150 mm) above surface of ground.
   e. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
   f. Plant materials larger than those specified may be supplied, with prior written approval of Landscape 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's of height.

2.2 ACCESSORIES

A. Planting Mix:
   1. Mixture of three (3) parts excavated soil and one part well rotted composted manure, approved commercial mix, or other amendment recommended in 'Topsoil Testing Report'.

B. Fertilizer:
   1. Fertilizer as recommended on ‘Topsoil Testing Report’.

C. Tree Stakes:
   1. Acceptable Products:
      a. 2 inch (50 mm) diameter Lodgepole Pine.
      b. Equal as approved by Landscape Architect before installation.

D. Tree Staking Ties:
   1. 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 Landscape Architect before installation.

E. Tree Guys:
   1. Acceptable Products:
      a. Duckbill Model 68DTS guying kit.
      b. Equal as approved by Landscape Architect before installation.

F. Pre-Emergent Herbicide:
   1. Acceptable Products:
      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 Crop Science, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Evaluation And Assessment:
   1. 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.
   2. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Contract Documents. All planting indicated on Contract Documents is required unless indicated otherwise.
   3. Do not commence with this Work until grading tolerances specified in Section 32 9122 ‘Topsoil Grading’ are met.

3.2 PREPARATION

A. Plant Approval:
   1. Compliance:
      a. Prior to any plant installation, evaluate plants for compliance with material standards.
      b. Remove plants from site that do not comply.
   2. Inspection:
      a. Prior to any tree installation, inspect one (1) extra deciduous tree and one (1) extra evergreen tree for root health.
      b. In presence of Landscape Architect or by video recording, remove root container/packing material and inspect root balls for soil depth, firmness and root structure by washing soil off of roots.
      c. If delivered plants exhibit soil 1 inch (25 mm) or more above root collar, demonstrate that all trees have had excess soil removed prior to planting or that they meet standard.
      d. If roots are loose, significantly circling, significantly asymmetrical or damaged, all tree plant material to be removed from site and replaced.
      e. Continue inspection process until trees meet standard.

B. Layout individual tree and shrub locations and areas for multiple plantings:
   1. Stake locations and outline areas.
   2. Secure Landscape Architect 's acceptance before planting.
   3. Make minor adjustments as may be requested.

3.3 INSTALLATION

A. Interface With Other Work:
   1. Do not commence work of this Section until work of Section 32 9122 has been completed and approved.

B. Excavation:
   1. If underground construction work or obstructions are encountered in excavation of planting holes, Landscape Architect will select alternate locations.
   2. Plant Excavation Size:
      a. Diameter: Twice diameter of root ball or container minimum.
      b. Depth: Equal to container or rootball depth.

3. Unless excavated material meets topsoil requirements as specified in Section 32 9113, remove from landscape areas and do not use for landscaping purposes.
4. Roughen sides and bottoms of excavations.
5. With approval of Landscape Architect, select five (5) typical planting excavations throughout site for drainage testing.
    a. Fill selected excavations with water and verify that water drains away at rate of 3 inches (75 mm) per hour minimum. Inform Landscape Architect in writing of excavations where water does not drain properly.
    b. Select three (3) excavations approximately 5 feet (1 500 mm) away from each non-draining excavation and repeat tests. Continue testing process until non-draining areas have been identified.
    c. In excavations located in identified non-draining areas, auger 6 inch (150 mm) diameter hole 4 feet (1 200 mm) deep in low point of each excavation and fill with tamped planting mix.
    d. Do not plant trees or shrubs in holes that do not properly drain.

C. 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 root ball and tree trunk.
    c. Remove plastic containers.
    d. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
2. Plant immediately after removing binding material and containers:
    a. Place tree and shrub root balls on undisturbed soil.
    b. After watering and settling, top of tree root balls shall be approximately two inches (50 mm) higher than finished grade and trunk flare is visible.
    c. Shrub root balls shall be approximately one inch (25 mm) higher than finished grade.
3. Properly cut off broken or frayed roots.
4. Center plant in hole, remove remaining wire basket and burlap taking care not do damage root ball:
    a. Replace damaged material.
    b. Backfill with specified planting mix.
    c. Except in heavy clay soils, make ring of mounded soil around hole perimeter to form watering basin.
5. Add fertilizer in plant pit as per ‘Topsoil Testing Report’ and during proper season.
6. Fill landscape excavations with tamped planting mix and recommended fertilizer:
    a. Compact in 6 inch (150 mm) lifts.
    b. Settle by watering to ensure top of root ball is 2 inches (50 mm) higher for trees and one inch (25 mm) higher for shrubs than surrounding soil following compaction and settling.
7. Do not use muddy soil for backfilling.
8. Make adjustments in positions of plants as directed by Landscape Architect.
9. Thoroughly water trees and shrubs immediately after planting.
10. At base of each tree, leave 36 inch (900 mm) diameter circle free of any grass.

D. Supports for New Trees:
1. Provide new supports for trees noted on Contract Documents to be staked.
    a. Remove nursery stakes delivered with and attached to trees.
    b. Support shall consist of at least two (2) tree stakes driven into hole base before backfill so roots are not damaged. Place stakes vertically and run parallel to tree trunk. Install stakes so 3 feet (900 mm) of stake length is below finish grade.
    c. Deciduous Trees:
        1) Place tree ties 6 to 12 inches (150 to 300 mm) below crotch of main tree canopy. Second set of tree ties may be required 18 to 24 inches (450 to 600 mm) above finish grade, if directed by Landscape Architect.
        2) Remove tops of tree stakes so top of stake is 6 inches (150 mm) below main tree canopy to prevent damage to tree branches and canopy growth.
    d. Evergreen Trees:
        1) Place tree ties 2/3's of height of tree up from root ball.
2. Provide root guying kits to support 24 inch (600 mm) box, 3 inch (75 mm) caliper and larger trees.
3. Staking and guying should allow some tree movement.

E. Vines:
1. Remove from stakes, untie, and securely fasten to wall or fence next to which they are planted.

F. Ground Covers:
   1. Container-grown unless otherwise specified on Contract Documents. Space evenly to produce a uniform effect, staggered in rows and intervals shown.

G. Post Planting Weed Control:
   1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
   2. Areas shall be weed free growth before application of herbicide.

H. Weed Barrier Fabric:
   1. After planting and application or herbicide in shrub beds, apply covering of specified weed barrier fabric.
   2. Achieve 100 percent coverage over ground areas.
   3. Overlap seams 6 inches (150 mm) minimum.
   4. Staple at 5 feet (1500 mm) on center each way and within 3 inches (75 mm) of edge of shrub bed, with two (2) at each corner.

I. Mulching:
   1. After application of herbicide, mulch shrub and ground cover planting areas with 3 inches (75 mm) deep layer of specified top dressing or rock mulch.
   2. Cover grass-free area at tree bases with 3 inches (75 mm) of top dressing mulch or rock mulch.
   3. Place mulch to uniform depth and rake to neat finished appearance.

END OF SECTION

SECTION 33 00 10
DIVISION 33 TABLE OF CONTENTS

DIVISION 33 - UTILITIES

33 08 00 - Commissioning of Utilities

33 10 00 - Water Utilities

33 30 00 - Sanitary Sewerage

33 40 00 - Storm Drainage Utilities

END OF SECTION

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SECTION 33 08 00
COMMISSIONING OF UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes specific requirements that apply to the implementation of the Commissioning Process and this Division Contractors' participation in this process. This section details the project specific equipment and systems that are included in the Commissioning Process. For general descriptions and responsibilities, refer to SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.02 RELATED DOCUMENTS

A. The Owner's Project Requirements (OPR) document.

B. The Basis of Design (BoD) document.

C. The Project Commissioning Plan (CxP) document.

D. ASHRAE Standard 202-2013 - Commissioning Process for Buildings and Systems.

E. LEED v4 for Building Design and Construction.

1.03 RELATED SECTIONS

A. SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

B. SECTION 07 08 00 - COMMISSIONING OF THERMAL AND MOISTURE PROTECTION

C. SECTION 08 08 00 - COMMISSIONING OF OPENINGS

D. SECTION 11 08 00 - COMMISSIONING OF EQUIPMENT

E. SECTION 13 08 00 - COMMISSIONING OF SPECIAL CONSTRUCTION

F. SECTION 14 08 00 - COMMISSIONING OF CONVEYING SYSTEMS

G. SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

H. SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

I. SECTION 23 08 00 - COMMISSIONING OF MECHANICAL SYSTEMS

J. SECTION 25 08 00 - COMMISSIONING OF INTEGRATED AUTOMATION SYSTEMS

K. SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

L. SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

M. SECTION 28 08 00 - COMMISSIONING OF SAFETY AND SECURITY SYSTEMS

1.04 DEFINITIONS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

1.05 RESPONSIBILITIES

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

PART 2 PRODUCTS

2.01 NO PRODUCTS SUPPLIED

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

B. Contractors and/or Vendors shall provide the specialty testing equipment necessary to fulfill the functional testing requirements, for the duration of the testing period.

PART 3 EXECUTION

3.01 GENERAL

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.02 MEETINGS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.03 SYSTEM START-UP

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.04 PRE-FUNCTIONAL CHECKLISTS

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.05 FUNCTIONAL PERFORMANCE TESTING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.06 TRAINING

A. For general descriptions, definitions, and responsibilities, refer to Section 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS.

3.07 SYSTEMS TO BE COMMISSIONED

A. GENERAL
   1. Commissioning specifications supplement the requirements of individual specifications sections but shall not be interpreted to replace or diminish the specified scope of any individual section.
   2. For all systems listed below, Division Contractor shall comply with all commissioning requirements specified.

B. APPLICABLE SYSTEMS
   1. Water Service
   2. Sanitary Sewers
   3. Electrical Services
   4. Communication Services

END OF SECTION

SECTION 33 10 00
WATER UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service, fire-service mains, and combined water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.02 RELATED SECTIONS

A. Section 00 31 00 - Available Project Information.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 01 91 13 - General Commissioning Requirements.

F. Section 33 08 00 - Commissioning of Utilities.

1.03 DEFINITIONS

A. DIP: Ductile iron pipe

B. EPDM: Ethylene propylene diene monomer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. PA: Polyamide (nylon) plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

H. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

I. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
   1. Wiring Diagrams: Power, signal, and control wiring for alarms.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of Local Water District. Include tapping of water mains and backflow prevention.

2. Comply with standards of Local Water District for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. 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.

D. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:
1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping 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.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
1. Notify Architect/Engineer no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Architect's/Engineer’s written permission.

1.08 COORDINATION

A. Coordinate connection to water main with local water district.

PART 2 PRODUCTS

2.01 GENERAL

A. All products shall be per Local Water District approved products list.

2.02 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B88, Type K, water tube, annealed temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
   2. Copper, Pressure-Seal Fittings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Viega; Plumbing & Heating Systems.
         2) Or approved equal.
      b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
      c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B88,Type K, water tube, drawn temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
   2. Copper, Pressure-Seal Fittings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Viega; Plumbing & Heating Systems.
         2) Or approved equal.
      b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
      c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile Iron Pipe, Ductile-Iron Pipe shall be cement lined with an AWWA C151/21.51 ductile or grey iron standard pattern Wall Thickness Class 52 and with a pressure class rating of 350 psi. Cement lining shall comply with ANSI/AWWA C104/A21.4.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

D. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
   1. Grooved-End, Ductile-Iron Pipe Appurtenances:
      a. 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:
      b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Anvil International, Inc.
         2) Victaulic Company of America.

3) Or approved equal.

c. Grooved-End, Ductile-Iron Fittings: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe.

d. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Flanges: ASME 16.1, Class 150, cast iron.

2.04 POLY VINYL CHLORIDE (PVC) PIPE

A. Poly Vinyl Chloride (PVC) Water Main Pipe Material compound shall meet ASTM D1784 Cell Class 1245B and AWWA C900. Pipes shall be plain end or gasket bell end, Pressure Class 150 (DR18) with cast iron pipe equivalent OD.

B. Poly Vinyl Chloride (PVC) Water Main Fittings shall be gray-iron or ductile iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement motor lining conforming to AWWA C104/A21.4, standard thickness unless noted otherwise on drawings. Fittings shall be Mechanical Joints.

C. PVC joints and jointing materials shall be as follows:
1. Pipe Joints shall be pushed on joints as specified in ASTM D3139.
2. Joints between pipe and metal fittings, valves and other accessories shall be mechanical joints as specified in AWWA C111/A21.11.
3. Provide each joint connection with an elastomeric gasket suitable for bell or coupling for which it is intended.
4. Gaskets for push on joints for pipe shall conform to ASTM F477.
5. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves and other accessories shall be as specified in AWWA C111/A21.11.
6. Sleeves type mechanically coupled joints may be used in lieu of push on joints on plain-end PVC plastic joints in ASTM D3139.

2.05 JOINING MATERIALS

A. Refer to Division 2 Section "Piped Utilities - Basic Materials and Methods" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.06 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
1. Standards: ASTM A674 or AWWA C105.
2. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
3. Color: Black.

2.07 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. East Jordan Iron Works, Inc.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.

h. McWane, Inc.; M & H Valve Company Div.
i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
j. Mueller Co.; Water Products Div.
k. NIBCO INC.
l. S. Pipe and Foundry Company.

2. Non-rising-Stem, Metal-Seated Gate Valves:
   a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 250 psig (1380 kPa).
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
3. Non-rising-Stem, Resilient-Seated Gate Valves:
   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig (1380 kPa).
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
4. Non-rising-Stem, High-Pressure, Resilient-Seated Gate Valves:
   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig (1725 kPa).
      3) End Connections: Push on or mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
   a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 250 psig (1380 kPa).
      3) End Connections: Flanged.
6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
   a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig (1380 kPa).
      3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:
   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. American Cast Iron Pipe Co.; American Flow Control Div.
      b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
      e. McWane, Inc.; Kennedy Valve Div.
      f. McWane, Inc.; M & H Valve Company Div.
      g. Mueller Co.; Water Products Div.
      h. NIBCO INC.
      i. S. Pipe and Foundry Company.
   3. UL/FMG, Nonrising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 250 psig (1207 kPa).
3) End Connections: Flanged.

4. OS&Y, Rising-Stem Gate Valves:
a. Description: Iron body and bonnet and bronze seating material.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 250 psig (1207 kPa).
3) End Connections: Flanged.

C. Bronze Gate 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 Div.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
2. OS&Y, Rising-Stem Gate Valves:
a. Description: Bronze body and bonnet and bronze stem.
1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 250 psig (1207 kPa).
3) End Connections: Threaded.
3. Non-rising-Stem Gate Valves:
a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
1) Standard: MSS SP-80.

2.08 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b. East Jordan Iron Works, Inc.
c. Flowserve.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.
h. S. Pipe and Foundry Company.
2. Description: Sleeve and valve compatible with drilling machine.
a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.09 CHECK VALVES

A. AWWA Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American AVK Co.; Valves & Fittings Div.
b. American Cast Iron Pipe Co.; American Flow Control Div.
c. APCO Williamette; Valve and Primer Corporation.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.
h. McWane, Inc.; M & H Valve Company Div.
i. Mueller Co.; Water Products Div.
j. NIBCO INC.
k. Watts Water Technologies, Inc.
2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
a. Standard: AWWA C508.
b. Pressure Rating: 175 psig (1207 kPa).

B. UL/FMG, Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Globe Fire Sprinkler Corporation.
d. Kidde Fire Fighting.
e. MATCO-NORCA, Inc.
f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
g. McWane, Inc.; Kennedy Valve Div.
h. Mueller Co.; Water Products Div.
i. NIBCO INC.
j. Reliable Automatic Sprinkler Co., Inc.
k. Tyco Fire & Building Products.
l. United Brass Works, Inc.
m. Victaulic Company of America.
n. Viking Corporation.
o. Watts Water Technologies, Inc.
2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 250 psig (1725 kPa).

2.10 DETECTOR CHECK VALVES

A. Detector Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Badger Meter, Inc.

c. FEBCO; SPX Valves & Controls.
d. Globe Fire Sprinkler Corporation.
e. McWane, Inc.; Kennedy Valve Div.
f. Mueller Co.; Hersey Meters.
g. Victaulic Company of America.
h. Viking Corporation.
i. Watts Water Technologies, Inc.

2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 250 psig (1207 kPa).
   c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
3. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 250 psig (1207 kPa).

2.11 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:
   1. Manufacturers:
      a. Mueller Co.; Water Products Div.
      b. Or approved equal.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
   1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
   2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
   3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.
   1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.12 WATER METERS

A. Water meters will be furnished by utility company.

2.13 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers: As approved by Local Water District.

B. Double-Check, Backflow-Prevention Assemblies:
   1. Manufacturers: As approved by Local Water District.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:
   1. Manufacturers: As approved by Local Water District.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers: As approved by Local Water District.

E. Backflow Preventer Test Kits:
1. Manufacturers: Subject to approval by Local Water District.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.14 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.
1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.

2.15 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857 and made according to ASTM C858.
1. Ladder: ASTM A36/A36M, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A48/A48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
a. Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.
3. Manhole: ASTM A536, Grade 60-40-18, ductile-iron traffic frame and cover.
a. Dimension: 24-inch- (610-mm-) minimum diameter, unless otherwise indicated.
4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.16 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Aqua Shield.
b. BF Products, Inc.
c. DekoRRa Products.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box, Inc.
g. HydroCowl, Inc.
h. Watts Water Technologies, Inc.
2. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
a. Standard: ASSE 1060.
b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
1) Housing: Reinforced fiberglass construction.
(a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.

(b) Drain opening for units with drain connection.
(c) Access doors with locking devices.
(d) Insulation inside housing.
(e) Anchoring devices for attaching housing to concrete base.
2) Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Aqua Shield.
b. BF Products, Inc.
c. DekoRRa Products.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box, Inc.
g. HydroCowl, Inc.
h. Watts Water Technologies, Inc.
2. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
a. Standard: ASSE 1060.
b. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
1) Housing: Reinforced fiberglass construction.
(a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
(b) Drain opening for units with drain connection.
(c) Access doors with locking devices.
(d) Anchoring devices for attaching housing to concrete base.

C. Enclosure Bases:
1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

2.17 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
1. Manufacturers: As pre-approved by water purveyor Local Water District.
2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
a. Standard: AWWA C502.
b. Pressure Rating: 250 psig.
3. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
a. Standards: UL 246, FMG approved.
b. Pressure Rating: 250 psig.
c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.18 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
   1. Manufacturers: As acceptable to the local fire department:

PART 3 EXECUTION

3.01 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping as shown on the plan shall be any of the following:
   1. Soft copper tube, ASTM B88, Type K.
   2. PE, ASTM pipe; insert fittings for PE pipe; and clamped joints.
   3. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
   4. NPS 1 to NPS 3 (DN 25 to DN 80) fiberglass, AWWA RTRP, Class 250; RTRF; and bonded joints.
   5. Fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

F. Underground water-service piping as shown on the plans shall be any of the following:
   1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
   2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings.
   3. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
   4. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
   5. NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 fabricated fittings; and gasketed joints.
   6. NPS 8 (DN 200): PVC, AWWA Class 200 pipe; push-on-joint, ductile-iron or mechanical-joint, ductile-iron fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be any of the following:
   1. Hard copper tube, ASTM B88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.
   2. PVC, Schedule 80 pipe; PVC, Schedule 80 joints.

I. Aboveground and vault water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be any of the following:
   1. Ductile-iron, flanged-end pipe; ductile-iron, flanged-end appurtenances; and flanged joints.

J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be any of the following:
   1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical ductile-iron-pipe appurtenances; and joints.

K. Aboveground[and Vault Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be ductile-iron, flanged-end pipe; ductile-iron-pipe appurtenances; and flanged joints.

L. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be any of the following:

1. Ductile-iron pressure Class 350, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical joint fittings; and mechanical joints.

M. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping [NPS 6 to NPS 12 (DN 150 to DN 300)] shall be ductile-iron, flanged-end pipe; ductile-iron-pipe appurtenances; and flanged joints.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, non-rising-stem-seated gate valves with valve box.
   2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, non-rising stem.
      b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
      c. Check Valves: AWWA C508, swing type.
   4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
   5. Relief Valves: Use for water-service piping in vaults and aboveground.
      a. Air-Release Valves: To release accumulated air.
      b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
      c. Combination Air Valves: To release or admit air.
   6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.04 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping-system common requirements.

3.05 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
   3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.

4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105.

G. Install PE pipe according to ASTM D2774 and ASTM F645.

H. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

I. Install fiberglass AWWA pipe according to AWWA M45.

J. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

K. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

L. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

M. Sleeves are specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."

N. Mechanical sleeve seals are specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

P. See Division 13 Section "Fire-Suppression Piping" for fire-suppression-water piping inside the building.

Q. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

3.06 JOINT CONSTRUCTION

A. Make pipe joints according to the following:
1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139 and pipe manufacturer's written instructions.
7. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
8. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Piped Utilities - Basic Materials and Methods" for joining piping of dissimilar metals.

3.07 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Heat-fused joints.
   6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
   4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.09 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install meter supplied by the water purveyor.

3.10 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.11 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.12 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.13 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches (50 mm) above surface.

3.14 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C891.

3.15 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.16 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.17 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.18 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards where indicated on the plan each fire department connection. Pipe bollards are specified in Division 5 Section "Metal Fabrications."

3.19 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.
   1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
   2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:
   1. Valves: Install chain and padlock on open OS&Y gate valve.
   2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 13 Section "Fire Alarm."

3.20 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping connections to valves and equipment.

C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve or service clamp and corporation valve as approved by Local Water District.

D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.21 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.22 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 2 Section "Earthwork."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for identifying devices.

3.23 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 30 00
SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipe and fittings.
   2. Non-pressure couplings.
   3. Expansion joints and deflection fittings.
   4. Cleanouts.
   5. Encasement for piping.
   6. Manholes.

1.02 RELATED SECTIONS

A. Section 00 31 00 – Available Project Information: Geotechnical Report

1.03 SUBMITTALS

A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

B. Product Certificates: For each type pipe and fitting, from manufacturer.

C. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

D. Field quality-control reports.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes per manufacturer's written rigging instructions.

1.05 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage 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 per requirements indicated:
   1. Notify Local Water District no fewer than three (3) days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Local Water District written permission.

PART 2 PRODUCTS

2.01 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS N/A

A. Pipe: ASTM A746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.02 VITRIFIED CLAY PIPE (VCP) AND FITTINGS

A. All pipe and fittings shall conform to Local Water District standards and specifications

2.03 PVC PIPE AND FITTINGS

A. All pipe and fittings shall conform to Local Water District standards and specifications

2.04 PVC GRAVITY SEWER PIPING

A. All pipe and fittings shall conform to Local Water District standards and specifications

B. All cleanouts shall conform to Local Water District standards and specifications

2.05 MANHOLES

A. Standard Precast Concrete Manholes:

B. Designed Precast Concrete Manholes:

C. Manhole Frames and Covers:

D. Manhole-Cover Inserts:

E. All manhole-cover inserts shall conform to Local Water District standards and specifications
   1. Campbell.
   2. East Jordan.
   3. Neenah.

2.06 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
   1. Shall be in accordance with the plans and these specifications.
   2. Cement: ASTM C150, Type II.
   3. Fine Aggregate: ASTM C33, sand.
   4. Coarse Aggregate: ASTM C33, crushed gravel.
   5. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
   1. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.
   2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 2500 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   2. Benches: Concrete, sloped to drain into channel with an 8% slope towards channel.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A185/A185M, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling shall be in conformance with Local water District standards or the geotechnical engineer’s recommendations, whichever is more stringent.

3.02 PIPING INSTALLATION

A. Shall be in accordance with the

B. Local Water District standards and specifications

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping per the following:
   1. Join ductile-iron, gravity sewer piping per AWWA C600 for push-on joints.
   2. Join PVC Type PSM sewer piping per ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.

3. Join PVC gravity sewer piping per ASTM D2321-92 and -ASTM D3034 for elastomeric-gasket joints.
4. Join reinforced-concrete sewer piping per ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
2. Use pressure pipe couplings for force-main joints.

3.04 MANHOLE INSTALLATION

A. General: Shall be in accordance with Local Water District standards and specifications

3.05 CONCRETE PLACEMENT

A. Place cast-in-place concrete per ACI 318.

3.06 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe for riser extensions to cleanouts in paved areas. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use PVC in earth or unpaved foot-traffic areas with non-slip covers.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.07 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 15 Section "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to grease interceptors.

3.08 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
   1. Use detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.09 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include, but are not limited to the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems per requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 72 hours' advance notice.
   4. Submit separate report for each test.
   5. Hydrostatic Tests: Test sanitary sewerage per requirements of authorities having jurisdiction and the following:
      a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
      b. Close openings in system and fill with water.
      c. Purge air and refill with water.
      d. Disconnect water supply.
      e. Test and inspect joints for leaks.
   6. Air Tests: Test sanitary sewerage per requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Option: Test plastic gravity sewer piping per ASTM F1417.
      b. Option: Test concrete gravity sewer piping per ASTM C924 (ASTM C924M).
   7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).
      a. Ductile-Iron Piping: Test per AWWA C600, "Hydraulic Testing" Section.
      b. PVC Piping: Test per AWWA M23, "Testing and Maintenance" Chapter.
   8. Manholes: Perform hydraulic test per ASTM C969 (ASTM C969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Pressure pipe couplings.
4. Expansion joints and deflection fittings.
5. Backwater valves.
6. Cleanouts.
7. Drains.
8. Encasement for piping.
9. Manholes.
10. Channel drainage systems.
11. Catch basins.
12. Stormwater inlets.
13. Stormwater detention structures.
14. Pipe outlets.
15. Dry wells.
16. Stormwater disposal systems.

1.02 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.03 RELATED SECTIONS

A. Section 00 31 00 – Available Project Information (Geotechnical Evaluation)

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

F. Procurement:
1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
2. Submit inventory to Owner within 5 days of delivery of materials.
3. See Sections 01 33 00 and 01 60 00.

G. Field quality-control reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes per manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets per manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 per requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Architect's written permission.

PART 2 PRODUCTS

2.01 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C564, rubber.

C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A888 or CISPI 301.

B. CISPI-Trademarked, Shielded Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. ANACO-Husky.
      b. Dallas Specialty & Mfg. Co.
      c. Fernco Inc.
      d. Mission Rubber Company; a division of MCP Industries, Inc.
      e. Stant; a Tompkins company.
      f. Tyler Pipe.
   2. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Shielded Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. ANACO-Husky.
      b. Clamp-All Corp.
      c. Dallas Specialty & Mfg. Co.
      d. Mission Rubber Company; a division of MCP Industries, Inc.
      e. Stant; a Tompkins company.
      f. Tyler Pipe.
   2. Description: ASTM C1277 and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Shielded Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. MG Piping Products Company.
   2. Description: ASTM C1277 and ASTM A48/A48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.03 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A716, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.04 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:
   1. Pipe: AWWA C151, for push-on joints.
   2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
   3. Compact Fittings: AWWA C153, for push-on joints.
   4. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.

B. Mechanical-Joint Piping:
   1. Pipe: AWWA C151, with bolt holes in bell.
   2. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
   3. Compact Fittings: AWWA C153, with bolt holes in bells.
   4. Glands: Cast or ductile iron, with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
   5. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

2.05 STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: ASTM A760/A760M, Type I with fittings of similar form and construction as pipe.
   1. Special-Joint Bands: Corrugated steel with O-ring seals.
   2. Standard-Joint Bands: Corrugated steel.
   3. Coating: Aluminum.

2.06 ALUMINUM PIPE AND FITTINGS

A. Corrugated Aluminum Pipe and Fittings: ASTM B745/B745M, Type I with fittings of similar form and construction as pipe.
   1. Special-Joint Bands: Corrugated steel with O-ring seals.
   2. Standard-Joint Bands: Corrugated steel.

2.07 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D2751, with bell-and-spigot ends for gasketed joints.
   1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
   2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

2.08 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252M, Type S, with smooth waterway for coupling joints.
   1. Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
   2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   1. Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
   2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.09 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Piping:
   1. PVC Cellular-Core Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
   2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:
   1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
   3. Gaskets: ASTM F477, elastomeric seals.

C. PVC Profile Sewer Piping:
   1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

D. PVC Type PSM Sewer Piping:
   1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

E. PVC Gravity Sewer Piping:
   1. Pipe and Fittings: ASTM F679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

F. PVC Pressure Piping:
   1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: AWWA C900, Class 150 PVC pipe with bell ends
   3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Water-Service Piping:
   1. Pipe: ASTM D1785, Schedule 40 PVC, with plain ends for solvent-cemented joints.
   2. Fittings: ASTM D2466, Schedule 40 PVC, socket type.

2.10 FIBERGLASS PIPE AND FITTINGS

A. Fiberglass Sewer Pipe: ASTM D3262, RTRP for gasketed joints fabricated with Type 2, polyester or Type 4, epoxy resin.
   1. Liner: Reinforced thermoset.
   2. Grade: Reinforced, surface layer matching pipe resin.
   3. Stiffness: [9 psig (62 kPa)] [18 psig (124 kPa)] [36 psig (248 kPa)] [72 psig (496 kPa)].
   4. Reinforcement: Grade with finish compatible with resin.

B. Gaskets: ASTM F477, elastomeric seals.

2.11 CONCRETE PIPE AND FITTINGS

A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C14 (ASTM C14M), [Class 1] [Class 2] [Class 3], with [bell-and-spigot] [or] [tongue-and-groove] ends and [gasketed joints with ASTM C443 (ASTM C443M), rubber gaskets] [sealant joints with ASTM C990 (ASTM C990M), bitumen or butyl-rubber sealant].

B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76 (ASTM C76M).
   1. [Bell-and-spigot] [or] [tongue-and-groove] ends and [gasketed joints with ASTM C443 (ASTM C443M), rubber gaskets] [sealant joints with ASTM C990 (ASTM C990M), bitumen or butyl-rubber sealant]
   2. Class I, Wall A.
   3. Class II, Wall B.
   4. Class III, Wall B.
   5. Class IV, Wall C.
   6. Class V, Wall C.

2.12 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C443 (ASTM C443M), rubber.
   2. For Cast-Iron Soil Pipes: ASTM C564, rubber.
   3. For Fiberglass Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
   4. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
   5. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Dallas Specialty & Mfg. Co.
      b. Fernco Inc.
      c. Logan Clay Pipe.
      d. Mission Rubber Company; a division of MCP Industries, Inc.
      e. NDS Inc.
      f. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   2. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Cascade Waterworks Mfg.
      b. Dallas Specialty & Mfg. Co.
      c. Mission Rubber Company; a division of MCP Industries, Inc.
   2. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Fernco Inc.
      b. Logan Clay Pipe.
      c. Mission Rubber Company; a division of MCP Industries, Inc.
   2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.13 PRESSURE PIPE COUPLINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Cascade Waterworks Mfg.
   2. Dresser, Inc.
   3. Ford Meter Box Company, Inc. (The); Pipe Products Div.
   4. JCM Industries, Inc.
   5. Romac Industries, Inc.
   6. Smith-Blair, Inc.; a Sensus company.
   7. Victaulic Depend-O-Lok, Inc.
   8. Viking Johnson.

B. Description: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig (1035-kPa) minimum pressure rating and ends sized to fit adjoining pipes.

D. Center-Sleeve Material: Manufacturer's standard.

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material.

2.14 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron Flexible Expansion Joints:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. EBAA Iron Sales, Inc.
      b. Romac Industries, Inc.
      c. Star Pipe Products.
   2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Dresser, Inc.
      b. EBAA Iron Sales, Inc.
      c. JCM Industries, Inc.
      d. Smith-Blair, Inc.; a Sensus company.
   2. Description: 3-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. EBAA Iron Sales, Inc.
   2. Description: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for up to 15 degrees of deflection.

2.15 BACKWATER VALVES

A. Cast-Iron Backwater Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe.
      d. Watts Water Technologies, Inc.
      e. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
   2. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
   3. Horizontal type; with swing check valve and hub-and-spigot ends.
   4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
   5. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. Plastic Backwater Valves:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Canplas LLC.
      b. IPS Corporation.
      c. NDS Inc.
      d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.16 CLEANOUTS

A. Cast-Iron Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Tyler Pipe.
      e. Watts Water Technologies, Inc.
      f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
   2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   3. Top-Loading Classification(s): Heavy Duty.
   4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Canplas LLC.
      b. IPS Corporation.
      c. NDS Inc.
      d. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      e. Sioux Chief Manufacturing Company, Inc.
      f. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.
   2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.17 DRAINS

A. Cast-Iron Area Drains:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Tyler Pipe.
      e. Watts Water Technologies, Inc.
   2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
   3. Top-Loading Classification(s): Heavy Duty.

B. Cast-Iron Trench Drains:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Tyler Pipe.
      e. Watts Water Technologies, Inc.
      f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.6.3, 6-inch- (150-mm-) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.
3. Top-Loading Classification(s): Heavy Duty.

C. Steel Trench Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
a. Rockford Sanitary Systems, Inc.
2. Description: Factory fabricated from ASTM A242/A242M, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate. Include units of total length indicated, bottom outlet of size indicated, outlet strainer, acid-resistant enamel coating on inside and outside surfaces, and grate with openings of total free area at least two times cross-sectional area of outlet.
3. Plate Thicknesses: 1/4 inch (6.4 mm).
4. Overall Widths: 7-1/2 inches (190 mm).
a. Grate Openings: Selected by Architect from manufacturer's full standard range. [1/4 inch (6.4 mm) circular] [3/8 inch (9.5 mm) circular] [3/8 inch (9.5 mm) circular or 3/8-by-3-inch (9.5-by-76-mm) slots] [3/8-by-3-inch (9.5-by-76-mm) slots].

2.18 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) minimum thickness.

C. Form: Sheet.

D. Color: Natural.

2.19 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed per ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Fiberglass Manholes:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Associated Fiberglass Enterprises.
   b. Containment Solutions, Inc.
   c. F. Manufacturing, Inc.
2. Description: ASTM D3753.
3. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
4. Ballast: Increase thickness of concrete base as required to prevent flotation.
5. Base Section: Concrete, 6-inch (150-mm) minimum thickness.
6. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
7. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
8. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

D. Manhole Frames and Covers:
1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.20 CONCRETE

A. General: Cast-in-place concrete per ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A185/A185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to 3/4 of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A185/A185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.21 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
2. ABT, Inc.
3. ACO USA.
4. Innovative Plastic, Inc.; a subsidiary of T-H Marine Supplies, Inc.
5. Mea-Josam Div.; Josam Company.
6. Poly-Cast.

B. Sloped-Invert, Polymer-Concrete Systems:
1. Channel Sections:
a. Interlocking-joint, precast, modular units with end caps.
b. 4-inch (102-mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
c. Extension sections necessary for required depth.
d. Frame: Include gray-iron or steel frame for grate.
2. Grates:
a. Manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
b. Material: Gray iron.
3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

C. Narrow-Width, Level-Invert, Polymer-Concrete Systems:
1. Channel Sections:
a. Interlocking-joint, precast, modular units with end caps.
b. 5-inch (127-mm) inside width and 9-3/4-inch- (248-mm-) deep, rounded bottom, with level invert and with NPS 4 (DN 100) outlets in quantities, sizes, and locations indicated.
2. Grates:
a. Slots or perforations that fit recesses in channels.
b. Material: Gray iron.
3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Wide-Width, Level-Invert, Polymer-Concrete Systems:
1. Channel Sections:

a. Interlocking-joint, precast, modular units with end caps.
b. 8-inch (203-mm) inside width and 13-3/4-inch- (350-mm-) deep, rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.

2. Grates:
a. Slots or other openings that fit recesses in channels.
b. Material: Gray iron.
3. Covers: Solid gray iron if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

E. Drainage Specialties: Precast, polymer-concrete units.
1. Large Catch Basins:
a. 24-by-12-inch (610-by-305-mm) polymer-concrete body, with outlets in quantities and sizes indicated.
b. Gray-iron slotted grate.
c. Frame: Include gray-iron or steel frame for grate.
2. Small Catch Basins:
a. 19- to 24-inch by approximately 6-inch (483- to 610-mm by approximately 150-mm) polymer-concrete body, with outlets in quantities and sizes indicated.
b. Gray-iron slotted grate.
c. Frame: Include gray-iron or steel frame for grate.
3. Oil Interceptors:
a. Polymer-concrete body with interior baffle and four steel support channels and two 1/4-inch- (6.4-mm-) thick, steel-plate covers.
b. Steel-plate covers.
c. Capacity: 260 gallon (984 L).
d. Inlet and Outlet: NPS 6 (DN 150).
4. Sediment Interceptors:
a. 27-inch- (686-mm-) square, polymer-concrete body, with outlets in quantities and sizes indicated.
b. 24-inch- (610-mm-) square, gray-iron frame and slotted grate.

F. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

G. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.22 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Plastic, Channel Drainage Systems:
1. Modular system of plastic channel sections, grates, and appurtenances.
2. Designed so grates fit into frames without rocking or rattling.
3. Number of units required to form total lengths indicated.
4. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
5. ACO USA.
6. MultiDrain Systems, Inc.
7. NDS Inc.
8. Tuf-Tite Corporation.
9. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

B. Fiberglass Systems:
1. Channel Sections:
a. Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps.
b. Rounded or inclined inside bottom surface, with outlets in quantities, sizes, and locations indicated.
c. Width: 8 inches (203 mm).
2. Factory- or field-attached frames that fit channel sections and grates.

a. Material: Galvanized steel.
3. Grates with slots or perforations that fit frames.
a. Material: Gray iron.
4. Covers: Solid gray iron if indicated.
5. Drainage Specialties:
a. Large Catch Basins: 24-inch- (610-mm-) square plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.
b. Small Catch Basins: 12-by-24-inch (305-by-610-mm) plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.

C. PE Systems:
1. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
2. Grates: PE, ladder shaped; with stainless-steel screws.
3. Color: Gray unless otherwise indicated.
4. Drainage Specialties: Include the following PE components:
a. Drains: 4-inch- (102-mm-) diameter, round, slotted top; with NPS 4 (DN 100) bottom outlet.
b. Drains: 8-inch- (203-mm-) diameter, round, slotted top; with NPS 6 (DN 150) bottom outlet.
c. Drains: 4-inch- (102-mm-) square, slotted top; with NPS 3 (DN 80) bottom outlet.
d. Drains: 8-inch- (203-mm-) square, slotted top; with NPS 6 (DN 150) bottom outlet.
e. Catch Basins: 12-inch- (305-mm-) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.

D. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

E. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.23 CATCH BASINS

A. Standard Precast Concrete Catch Basins:
1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
9. Pipe Connectors: ASTM C923 (ASTM C923M), resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed per ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
1. Joint Sealants: ASTM C990 (ASTM C990M), bitumen or butyl rubber.

2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
4. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
5. Pipe Connectors: ASTM C923 (ASTM C923M), resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

D. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.24 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions per utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions per utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions per utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty, per utility standards.

2.25 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed per ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Ballast: Increase thickness of concrete as required to prevent flotation.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and cover.
3. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).

B. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.26 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone per NSSGA's "Quarried Stone for Erosion and Sediment Control."
1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).

C. Filter Stone: Per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: Per NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

2.27 DRY WELLS

A. Description: ASTM C913, precast, reinforced, perforated concrete rings. Include the following:
   1. Floor: Cast-in-place concrete.
   2. Cover: Liftoff-type concrete cover with cast-in lift rings.
   3. Wall Thickness: 4 inches (102 mm) minimum with 1-inch (25-mm) diameter or 1-by-3-inch- (25-by-76-mm-) maximum slotted perforations arranged in rows parallel to axis of ring.
      a. Total Free Area of Perforations: Approximately 15 percent of ring interior surface.
      b. Ring Construction: Designed to be self-aligning.
   4. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.

B. Description: Manufactured PE side panels and top cover that assemble into 50-gal. (190-L) storage capacity units.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. NDS Inc.
   2. Side Panels: With knockout ports for piping and seepage holes.
   3. Top Cover: With knockout port for drain.
   4. Filter Fabric: As recommended by unit manufacturer.
   5. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.

C. Description: Constructed-in-place aggregate type. Include the following:
   1. Lining: Clay or concrete bricks.
   2. Lining: Concrete blocks or precast concrete rings with notches or weep holes.
   3. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
   4. Cover: Precast, reinforced-concrete slab, designed for structural loading per ASTM C890 and made per ASTM C913. Include slab dimensions that will extend 12 inches (300 mm) minimum beyond edge of excavation, with bituminous coating over entire surface. Cast cover with opening for manhole in center.
   5. Manhole: 24-inch- (610-mm-) diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

2.28 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Advanced Drainage Systems.
      b. CULTEC, Inc.
      c. Hancor Inc.
      d. Infiltrator Systems, Inc.
      e. StormTech LLC.
   2. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
   3. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
   4. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd. (135 g/sq. m).

B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252M for NPS 10 (DN 250) and smaller, AASHTO M 294M for NPS 12 to NPS 60 (DN 300 to DN 1500). Include proprietary fittings, couplings, seals, and filter fabric.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Advanced Drainage Systems.
   b. Hancor Inc.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings per manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping per the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   3. Install piping with 24 inch (915-mm) minimum cover.
   4. Install hub-and-spigot, cast-iron soil piping per CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
   5. Install hubless cast-iron soil piping per CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
   6. Install ductile-iron piping and special fittings per AWWA C600 or AWWA M41.
   7. Install corrugated steel piping per ASTM A798/A798M.
   8. Install corrugated aluminum piping per ASTM B788/B788M.
   9. Install ABS sewer piping per ASTM D2321 and ASTM F1668.
   10. Install PE corrugated sewer piping per ASTM D2321.
   11. Install PVC cellular-core piping per ASTM D2321 and ASTM F1668.
   12. Install PVC sewer piping per ASTM D2321 and ASTM F1668.
   13. Install PVC profile gravity sewer piping per ASTM D2321 and ASTM F1668.
   14. Install PVC water-service piping per ASTM D2321 and ASTM F1668.
   15. Install fiberglass sewer piping per ASTM D3839 and ASTM F1668.
   16. Install nonreinforced-concrete sewer piping per ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
   17. Install reinforced-concrete sewer piping per ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main pressure piping per the following:
   1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   2. Install piping with 36 inch (915-mm) minimum cover.

3. Install ductile-iron pressure piping per AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings per AWWA C600.
5. Install PVC pressure piping per AWWA M23, or ASTM D2774 and ASTM F1668.
6. Install PVC water-service piping per ASTM D2774 and ASTM F1668.

H. Install corrosion-protection piping encasement over the following underground metal piping per ASTM A674 or AWWA C105:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Expansion joints and deflection fittings.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping per the following:
1. Join hub-and-spigot, cast-iron soil piping with gasketed joints per CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints per CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping per CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron culvert piping per AWWA C600 for push-on joints.
5. Join ductile-iron piping and special fittings per AWWA C600 or AWWA M41.
6. Join corrugated steel sewer piping per ASTM A798/A798M.
7. Join corrugated aluminum sewer piping per ASTM B788/B788M.
8. Join ABS sewer piping per ASTM D2321 and ASTM D2751 for elastomeric-seal joints.
9. Join corrugated PE piping per ASTM D3212 for push-on joints.
10. Join PVC cellular-core piping per ASTM D2321 and ASTM F891 for solvent-cemented joints.
11. Join PVC corrugated sewer piping per ASTM D2321 for elastomeric-seal joints.
12. Join PVC sewer piping per ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
13. Join PVC profile gravity sewer piping per ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
14. Join fiberglass sewer piping per ASTM D3839 for elastomeric-seal joints.
15. Join nonreinforced-concrete sewer piping per ASTM C14 (ASTM C14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping per ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

B. Join force-main pressure piping per the following:
1. Join ductile-iron pressure piping per AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings per AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping per AWWA M23 for gasketed joints.
4. Join PVC water-service piping per ASTM D2855 for solvent-cemented joints.
5. Join dissimilar pipe materials with pressure-type couplings.

3.04 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.06 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification drains in roads.

B. Embed drains in 4-inch (102-mm) minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch (102-mm) minimum concrete around bottom and sides.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants per ASTM C891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.08 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.09 STORMWATER INLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.10 DRY WELL INSTALLATION

A. Excavate hole to diameter of at least 6 inches (150 mm) greater than outside of dry well. Do not extend excavation into ground-water table.

B. Install precast, concrete-ring dry wells per the following:
1. Assemble rings to depth indicated.
2. Extend rings to height where top of cover will be approximately 8 inches (203 mm) below finished grade.
3. Backfill bottom of inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
4. Extend effluent inlet pipe 12 inches (300 mm) into rings and terminate into side of tee fitting.

5. Backfill around outside of rings with filtering material to top level of rings.
6. Install cover over top of rings.

C. Install manufactured, PE dry wells per manufacturer's written instructions and the following:
1. Assemble and install panels and cover.
2. Backfill bottom of inside of unit with filtering material to level at least above bottom.
3. Extend effluent inlet pipe 12 inches (300 mm) into unit and terminate into side of tee fitting.
4. Install filter fabric around outside of unit.
5. Install filtering material around outside of unit.

D. Install constructed-in-place dry wells per the following:
1. Install brick lining material dry and laid flat, with staggered joints for seepage. Build to diameter and depth indicated.
2. Install block lining material dry, with staggered joints and 20 percent minimum of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage. Build to diameter and depth indicated.
3. Extend lining material to height where top of manhole will be approximately 8 inches (203 mm) below finished grade.
4. Backfill bottom of inside of lining with filtering material to level at least 12 inches (300 mm) above bottom.
5. Extend effluent inlet pipe 12 inches (300 mm) into lining and terminate into side of tee fitting.
6. Backfill around outside of lining with filtering material to top level of lining.
7. Install manhole over top of dry well. Support cover on undisturbed soil. Do not support cover on lining.

3.11 CONCRETE PLACEMENT

A. Place cast-in-place concrete per ACI 318.

3.12 CHANNEL DRAINAGE SYSTEM INSTALLATION

A. Install with top surfaces of components, except piping, flush with finished surface.

B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

C. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.

D. Fasten grates to channel sections if indicated.

E. Assemble channel sections with flanged or interlocking joints.

F. Embed channel sections in 4-inch (102-mm) minimum concrete around bottom and sides.

3.13 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill per chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, per piping manufacturer's written instructions.

3.14 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 16 "Storm Drainage Piping."

B. Connect force-main piping to building's storm drainage force mains specified in Section 22 14 16 "Storm Drainage Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch

(150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
   a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
   b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to sediment interceptors specified in Division 22.

E. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
   a. [Unshielded] [Shielded] flexible couplings for same or minor difference OD pipes.
   b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.15 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch- (203-mm-) thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade per Division 31 Section "Earthwork."

3.16 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.17 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems per requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test per requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping per ASTM F1417.
      c. Option: Test concrete piping per ASTM C924 (ASTM C924M).
   6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).
      a. Ductile-Iron Piping: Test per AWWA C600, "Hydraulic Testing" Section.
      b. PVC Piping: Test per AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.18 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For manholes, catch basins and inlet boxes (include sections, details, frames and covers, and catch basin frames and grates).

C. Coordination Drawings: Show pipe sizes, locations, and elevations.

D. Field quality-control test reports. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 HDPE PIPE AND FITTINGS

A. Corrugated HDPE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated HDPE Drainage Pipe and Fittings NPS 12 and Larger: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Watertight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.3 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): Light and Heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

2.6 STORM DRAIN BOXES

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range:
1. NPS 3 to NPS 6: Corrugated PE drainage pipe and fittings, watertight couplings, and coupled joints.
2. NPS 8 to NPS 15: Corrugated PE drainage pipe and fittings, watertight couplings, and coupled joints.
3. NPS 18 to NPS 30: Corrugated PE pipe and fittings, watertight couplings, and coupled joints.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage 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.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at slope indicated.
2. Install piping with 24-inch minimum cover.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.4 CATCH BASIN INSTALLATION

A. Set lids to elevations indicated.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100

SECTION 41 00 10
DIVISION 41 TABLE OF CONTENTS

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

41 22 00 - Hoists and Cranes

END OF SECTION

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SECTION 41 22 00
HOISTS AND CRANES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cranes, Hoists and Lifts of the Following Types:
   1. Portable, Manual Davit Crane.

1.02 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC) - Manual of Steel Construction, Part 5, Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

B. ASTM International (ASTM):
   1. ASTM A36 - Carbon Structural Steel.
   2. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
   3. ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
   4. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. American Welding Society (AWS) D1.1 - Structural Welding Code.

F. Occupational Safety and Health Administration (OSHA) - Specification 1910.179 - Overhead and Gantry Cranes.

1.03 RELATED SECTIONS

A. Section 01 31 00 - Project Management and Coordination.

B. Section 01 33 00 - Submittal Procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 60 00 - Product Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete.

F. Section 05 31 00 - Steel Decking.

G. Section 26 05 00 - Common Work Results for Electrical.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Describe capacities, performance, operation, and applied forces to foundation.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Shop drawings showing configuration, dimensions, service area, and construction and installation details.

D. Procurement:
   1. Submit proof of procurement for all materials within 30 days of product submittal approval. Include proof of payment, delivery schedule and storage information.
   2. Submit inventory to Owner within 5 days of delivery of materials.
   3. See Sections 01 33 00 and 01 60 00.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in designing and manufacturing cranes with 25 years successful experience.

B. Installer Qualifications: Company experienced in assembly and installation of cranes with 5 years successful experience and acceptable to crane manufacturer.
   1. Perform welding by certified operators in accordance with AWS D14.1.
   2. Bolted connections shall be in accordance with torque tightening procedures specified in AISC Manual, Part 5.
   3. Clearly label crane with rated load capacity. Place label at height and location easily read from floor level and loading position.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace assemblies and components that fail in materials and workmanship within warranty period from date of Substantial Completion.
   1. 2 years warranty to cover defects in materials and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thern Winches and Cranes. 5712 Industrial Park Road, Winona, MN USA 1-800-843-7648. Phone 1.800.843.7648. www.thern.com

B. Substitutions: Not permitted.

2.02 PORTABLE DAVIT CRANE

A. Performance:
   1. Crane shall be designed, fabricated, and installed in accordance with ANSI B30.11 and OSHA 1910-179.
   2. Crane shall be designed for minimum effort manual rotation.
   3. Boom shall not drift when at rest.
   4. Maximum deflection at boom end: 1/150 span based on capacity plus 15 percent for hoist weight.
   5. Crane shall be designed to withstand the following:
      a. Live load capacity equal to net rated hook load: 850 pounds (386 kg).

B. Free Standing Portable Crane: Crane shall consist of mast requiring foundation support and a 360 degree rotating boom. Provide rotating collector assembly with service entrance and festoon service support as indicated.
   1. Acceptable Model:
      a. Crane:
         1) Product: First Mate 5PF5X-M3.
      b. Base:
         1) Pedestal base: 5BP5X
      c. Wire Rope Assembly:
         1) Galvanized Aircraft Cable: 36" length, 1/4" Dia (6.4 mm) WA25-36NS
      d. Accessories:
         1) Wire Rope Keeper:
            (a) RK19-25S

2. Construction: Fabricate from ASTM A36 steel sections with finished ends and surfaces.
3. Mast: Steel pipe, with cap, slides into and fastens to pedestal base.
4. Boom: Three-position adjustable steel tube boom, attached to mast with quick release stainless steel fasteners by Manufacturer.
5. Hoist Assembly: Manually operated spur gear - Stainless Steel.
6. Finish:
    a. Epoxy gray, where applicable.

2.03 SHOP FINISHING

A. Steel: See selections above:
    1. Finish color: Gray.

B. Aluminum or Stainless Steel: Mill finish.

C. Provide spray can of matching color, air-drying paint for field touch-up.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until support structures have been properly prepared.

B. Design and construction of reinforced concrete footings and slabs as detailed on Drawings and specified in other sections. Verify that accurate crane applied forces and anchor bolt patterns are provided for foundation design.

3.02 INSTALLATION

A. Install units and accessories in accordance with manufacturer's instructions and approved shop drawings. Do not modify crane components in any manner without advance written approval by crane manufacturer.

B. Clearances for Moving Crane Components:
    1. 3 inches (76.2 mm) minimum vertical clearance from any overhead obstruction.
    2. 2 inches (50.8 mm) minimum horizontal clearance from any lateral obstruction.
    3. Prior to applying proper torque to the bolts, ensure runways are:
        a. Level to within plus or minus 1/8 inch (3.18 mm) in 20 feet (609.6 cm).
        b. Parallel with opposite runway to within plus or minus 0.12 inch (3 mm) in 6.67 yard (6.1 meter)).

3.03 FIELD QUALITY CONTROL

A. Perform field quality control testing as recommended by manufacturer. Move bridge and hoist trolley through entire travel to ensure crane is clear of obstructions and moves freely and smoothly. Inspect installed crane. Verify all bolts are tight and lock washers fully compressed.

B. Field test crane and accessories for operating functions. Ensure crane movement is smooth and proper. Adjust as required and correct deficiencies.

C. Clean surfaces. If necessary, touch-up paint damage, scratches, and blemishes with manufacturer provided matching paint. Protect crane from other construction operations.

3.04 DEMONSTRATING AND TRAINING

A. Provide demonstration and training session for Owner's representative covering operation and maintenance.
    1. Include multiple copies of operational use and safety material for Owner's use.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Specifications

02/09/2026

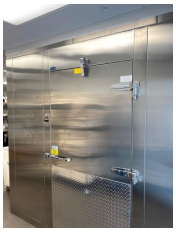
To	Project	From
Lifetime Health 2902 Corporate Place Chanhassen, MN 55317-	Lifetime - Holladay, UT 1975 East Rodeo Drive Holladay, UT	Boelter.Premier Foodservice Todd Olson/ John Nord 7120 Northland Terrace Minneapolis, MN 55428-1573 763-450-2939 (Contact)

Standard Terms

ITEM 1 - OFFICE EQUIPMENT - BY OTHERS

OFFICE EQUIPMENT - By Others

ITEM 2 - WALK IN, COMBINATION COOLER/FREEZER (1 REQ'D)



Custom Model WALK-IN

Custom walk-in cooler, freezer, 8'6" high Sized per plans with floorless cooler and freezer, stainless steel where exposed, 2ea 4' Flourescent Lights (one per box, bulbs not included), Diamond tread plate on front and back of all doors, S/s enclosure to walls and drop ceiling (9'). Vinyl U shaped screed. s/s thresholds in both doors

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ITEM 3A - EVAPORATOR (1 REQ'D)

Custom Model EVAPORATORS

Walk-In Cooler Evaporator, Included in 3B

ITEM 3B - COMPRESSORS (1 REQ'D)

Custom Model COMPRESSORS

Walk-In Cooler Outdoor Compressor System (208 volt 1 phase)

1 ea	Model WARRANTY 5 year compressor body warranty
1 ea	Model WARRANTY 1 year labor warranty

ITEM 4A - EVAPORATOR (1 REQ'D)

Custom Model EVAPORATOR

Walk-In Freezer Evaporator. (208 Volt 1 Phase)Included in 4B, 208V Reach-in Evap Coil

ITEM 4B - COMPRESSORS (1 REQ'D)

Custom Model COMPRESSORS

Walk-In Freezer Outdoor Compressor System. (208 Volt 1 Phase)

1 ea Model WARRANTY 5 year compressor body warranty

1 ea Model WARRANTY 1 year labor warranty

ITEM 4C - HEAT TAPE - BY OTHERS

Heat Tape - By Others

ITEM 5 - BUN / SHEET PAN RACK (2 REQ'D)



John Boos Model ABPR-1820-3KD-X Dimensions: 69(h) x 20.5(w) x 26(d)

Bun Pan Rack, mobile, (20) pan capacity, 3" spacing, front loading, 26"W x 20-1/2"D x 69"H, 1" square tube frame with bolted cross bracing, 5" swivel casters, 6063 aluminum construction, KD, NSF (Available in Effingham and Nevada)

ITEM 6 - SHELVING (1 lt REQ'D)



Centaur Model WALK-IN SHELVING

Walk-In freezer Shelving , 4 tier, 74" posts, green epoxy finish with chromate substrate, NSF, Sized Per Plan

4 ea Model C2142K Centaur®K Series Shelving, wire, 42"W x 21"D, green epoxy, NSF

16 ea Model C2148K Centaur®K Series Shelving, wire, 48"W x 21"D, green epoxy, NSF

20 ea Model C74K Centaur® Stationary Post, 74-5/8"H, with leveling bolt & cap, green epoxy

ITEM 7 - SHELVING (1 REQ'D)



Centaur Model WALK-IN SHELVING

Walk-In Cooler Shelving, 4-Tier, 74" posts, green epoxy finish with chromate substrate, NSF Sized Per Plan

20 ea Model C2148K Centaur®K Series Shelving, wire, 48"W x 21"D, green epoxy, NSF

4 ea Model C2130K Centaur®K Series Shelving, wire, 30"W x 21"D, green epoxy, NSF

4 ea Model C2136K Centaur®K Series Shelving, wire, 36"W x 21"D, green epoxy, NSF

28 ea Model C74K Centaur® Stationary Post, 74-5/8"H, with leveling bolt & cap, green epoxy

ITEM 8 - MOP SINK - BY OTHERS

Mop Sink - By Others

ITEM 8A - SHELVING, WALL MOUNTED (1 REQ'D)

John Boos Model EWS8-1224-X Dimensions: 9.5(h) x 24(w) x 12(d)



Shelf, wall-mounted, 24"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 8B - MOP HOLDER - BY OTHERS

Mop Holder - By Others

ITEM 9 - SHELVING (1 lt REQ'D)



Centaur Model SHELVING

Dish drying Shelving, 5-Tier, 86" posts, green epoxy finish with chromate substrate, NSF Sized Per Plan

- 5 ea Model C1854C Centaur® C Series Shelving, wire, 54"W x 18"D, chrome plated finish, NSF (priced per each, 4 each per pack)
- 4 ea Model C86K Centaur® Stationary Post, 86-5/8"H, with leveling bolt & cap, green epoxy

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ITEM 10 - SHELVING (1 REQ'D)



Centaur Model SHELVING

Chemical Shelving, 5-Tier, 86" posts, green epoxy finish with chromate substrate, NSF Sized Per Plan

- 5 ea Model C2124K Centaur®K Series Shelving, wire, 24"W x 21"D, green epoxy, NSF
- 4 ea Model C86K Centaur® Stationary Post, 86-5/8"H, with leveling bolt & cap, green epoxy

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ITEM 11 - THREE (3) COMPARTMENT SINK (1 REQ'D)

John Boos Model 3B16204-2D24-X Dimensions: 43(h) x 99(w) x 25.5(d)



"B" Series Sink, 3-compartment, 99-1/4"W x 25-1/2"D x 44"H overall size, (3) 16"W x 20" front-to-back x 14" deep compartments, (2) 24" left & right drainboards, 10"H boxed backsplash with 45° top and 2" return, (1) set of splash mount faucet holes with 8" centers, 3-1/2" die-stamped drain openings, 16/300 stainless steel construction, stainless steel legs, adjustable side bracing, adjustable bullet feet, NSF, CSA-Sanitation (Available in Effingham and Nevada)

- 1 ea Fisher Model 32530 Faucet, wall mount, 8" adjustable centers, 12" swing spout, lever handles with color coded indexes, 1/2" NPT female inlets, brass, ADA Compliant
- 3 ea Fisher Model 24090 Twist Waste Standard Valve, 3-1/2" industry standard sink opening, 2" drain outlet, flat strainer, stainless steel

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ITEM 11A - SHELF, WALL-MOUNTED (1 lt REQ'D)

John Boos Model WALL SHELF



Wall Shelf With Brackets as follows:.

- 1 ea Model EWS8-1296-X Shelf, wall-mounted, 96"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (3) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)
- 1 ea Model EWS8-1696-X Shelf, wall-mounted, 96"W x 16"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (3) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 12 - HAND SINK (1 REQ'D)



John Boos Model PBHS-W-1410-SSLR-X

Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, splash mount faucet holes with 4" centers, 1-7/8" drain opening with basket drain, with left & right side splashes, includes mounting bracket, all stainless steel construction, NSF, CSA-Sanitation (faucet NOT included) (Available in Effingham and Nevada)

1 ea Fisher Model 19960 Faucet, backsplash mount, 4" centers, 6"H swivel gooseneck spout, 2.2 gpm, check valves, lever handles with color coded indexes, 1/2" NPT male inlets, low lead

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ITEM 13 - DISHTABLE (1 REQ'D)

INFINITY METAL FABRICATING Model DISHTABLE

Clean dish table with under shelf, 6', left to right , 10" Backsplash, 16/304 stainless steel top, 10"H boxed back splash, stainless steel legs & undershelf, stainless steel bullet feet, Per plan. Field Verify, NSF

ITEM 14 - SHELF, WALL-MOUNTED (1 lt REQ'D)



John Boos Model WALL SHELF

Wall Shelf With Brackets as follows:.

1 ea Model EWS8-1248-X Shelf, wall-mounted, 48"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 15 - SPARE NO.

ITEM 16 - DISHWASHER, DOOR TYPE (1 REQ'D)



Jackson WWS Model TEMPSTAR

TempStar® Dishwasher, door type, high temperature electric tank heat with built-in booster, universal (straight-thru/corner) type, approximately (63) racks/hour capacity (0.89 gallons per rack), stainless steel exterior, electro-mech controls, universal timer, Sani-Sure™, auto tank fill, door actuated start, dishtable not included, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea 1 yr. parts & labor warranty, continental USA, Hawaii & Canada (std)
1 ea 208V/60/3, std.
1 ea 1 year parts & labor warranty, continental USA, standard
1 ea 70 degree rise booster heater, standard
1 ea Voltage to be verified with jobsite
1 ea Model 06401-004-85-80 Drain Water Tempering Kit (DynaStar models, TempStar® models and NXP-HTD)

ITEM 17 - HOOD (1 REQ'D)



Captive-Aire Model 4830VHB-G

4830VHB-G - 4ft 0" Long Condensate Hood, w/ Full Perimeter Gutter
- 430 SS - 100% Application
- EXHAUST RISER - Factory installed 12" Diameter X 4" Height

1 ea Model TRIM WRAPPER - FIELD WRAPPER 11.00" High Front, Right

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ITEM 18 - DISHTABLE (1 REQ'D)

INFINITY METAL FABRICATING Model DISHTABLE

Soiled dishtable, 6' x 5' , provision for disposer package, open base.. , 16/304 stainless steel top, 10"H boxed back splash, 20"W x 20"D x 8"deep pre-rinse sink bowl, rack slide, with splash mount faucet holes 8" o/c, stainless steel legs & bracing, stainless steel bullet feet, Per plan Field Verify NSF

1 ea Fisher Model 22100 Pre-Rinse Assembly, 8" adjustable centers, wall-mounted mixing valve, with spring action flexible gooseneck, with Ultra-Spray™/PLUS spray valve (1.15 gallons per minute @ 60 PSI), with wall bracket

1 ea Fisher Model 29060 Add-On-Faucet, for rigid control valves, with 6" swing spout, 3/8" male inlet, brass

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ITEM 18A - GARBAGE - BY OTHERS

Garbage - By Others

ITEM 19 - DISPOSER (1 REQ'D)



Salvajor Model 100-SA-6-MRSS

Disposer, Sink Assembly, 6-1/2" sink collar, 1 Hp motor, start/stop push button manual reversing MRSS control, includes fixed nozzle, chrome plated vacuum breaker, solenoid valve, sink stopper & flow control, heat treated aluminum alloy housing, UL, CE

1 ea 208v/60/3-ph, 4.9 amps

1 ea Model LSA8 Disposer support leg, for 3/4 HP - 2 HP disposers

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ITEM 20 - SPARE NO.

ITEM 21 - DISHTABLE SORTING SHELF (1 REQ'D)



John Boos Model PB-SRW-42 Dimensions: 16.5(h) x 42(w) x 15.38(d)

Sorting Shelf, 42"W x 15-3/8"D X 16-1/2"H, holds (2) racks, wall mounted, solid, includes brackets, 18/300 stainless steel, NSF

ITEM 22 - HAND SINK (1 REQ'D)



John Boos Model PBHS-W-1410-SSLR-X

Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, splash mount faucet holes with 4" centers, 1-7/8" drain opening with basket drain, with left & right side splashes, includes mounting bracket, all stainless steel construction, NSF, CSA-Sanitation (faucet NOT included) (Available in Effingham and Nevada)

1 ea Fisher Model 19960 Faucet, backsplash mount, 4" centers, 6"H swivel gooseneck spout, 2.2 gpm, check valves, lever handles with color coded indexes, 1/2" NPT male inlets, low lead

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ITEM 23 - GARBAGE - BY OTHERS

Garbage - By Others

ITEM 24 - IMMERSION BLENDER (1 REQ'D)



Waring Model WSB50

Big Stix® Immersion Blender, heavy duty, 40 qt. (10 gallon) capacity, 12" stainless steel removable shaft, variable speed motor, continuous ON feature, rubberized comfort grip, 1 HP, 120v, 750W, 6.25 amps, NSF

1 ea Standard 1-year limited warranty

1 ea Model WSB01 Big Stix® Wall Hanger, for WSBPP, WSB50, WSB55, WSB60, WSB65, WSB70 & WSBPPW

ITEM 25 - SPARE NO.

ITEM 26 - SPARE NO.

ITEM 27 - PREP SINK (1 REQ'D)

INFINITY METAL FABRICATING Model WORK TABLE

Custom 7' x 30" Veg Prep Sink with stack of 3 drawers (each drawer: 20"W x 20"D x 5"deep, stainless steel front & drawer pan, roller bearing slides) , 16" x 20" x 12" deep sink on left, 8" OC holes for faucet, 6" high back splashe. 16/304 stainless, NSF

1 ea Fisher Model 32530 Faucet, wall mount, 8" adjustable centers, 12" swing spout, lever handles with color coded indexes, 1/2" NPT female inlets, brass, ADA Compliant

1 ea Fisher Model 24090 Twist Waste Standard Valve, 3-1/2" industry standard sink opening, 2" drain outlet, flat strainer, stainless steel

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ITEM 28 - SHELF, WALL-MOUNTED (1 lt REQ'D)



John Boos Model WALL SHELF

Wall Shelf With Brackets as follows:.

1 ea Model EWS8-1284-X Shelf, wall-mounted, 84"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (3) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

1 ea Model EWS8-1684-X Shelf, wall-mounted, 84"W x 16"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (3) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 29 - SPARE NO.

ITEM 30 - SPARE NO.

ITEM 31 - SHELVING (1 lt REQ'D)



Centaur Model SHELVING

Dry Storage Shelving 5-Tier, 86" posts,chromate finish, NSF Sized Per Plan

5 ea	Model C1848C Centaur® Shelving C Series Shelving, wire, 48"W x 18"D, chrome plated finish, NSF
10 ea	Model C2148C Centaur® Shelving C Series Shelving, wire, 48"W x 21"D, chrome plated finish, NSF
10 ea	Model C2430C Centaur® Shelving C Series Shelving, wire, 30"W x 24"D, chrome plated finish, NSF
10 ea	Model C2442C Centaur® Shelving C Series Shelving, wire, 42"W x 24"D, chrome plated finish, NSF
32 ea	Model C86C Centaur® Stationary Post, 86-5/8"H, with leveling bolt & cap, chrome

ITEM 32 - PORTABLE BAR (1 REQ'D)



Advance Tabco Model AMD-5B Dimensions: 46.63(h) x 62.25(w) x 28.13(d)

Portable Bar, 62-1/4"W x 28-1/8"D x 46-5/8"H, stainless steel workboard & ice bin, BK style bottle troughs, stainless steel interior, enclosed storage with hinged stainless steel doors with locks & fixed center support panel, black mica top & exterior, full perimeter bumpers, 5" swivel casters (2 with brakes)

1 ea	Black front & sides, black laminate top (standard finish)

ITEM 33 - ICE MAKER, CUBE-STYLE (1 REQ'D)



Hoshizaki Model KM-1100MAJ Dimensions: 32.5(h) x 30(w) x 27.38(d)

Ice Maker, Cube-Style, 30"W, air-cooled, self-contained condenser, production capacity up to 1087 lb/24 hours at 70°/50° (935 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 208-230v/60/1-ph, 12.5 amps, NSF, UL

1 ea	Warranty: 3-Year parts & labor on entire machine
1 ea	Warranty: 5-Year parts & labor on evaporator
1 ea	Warranty: 5-Year parts on compressor & air-cooled condenser
1 ea	Model B-800SF Ice Bin, 48"W, top-hinged front-opening door, 800-lb ice storage capacity, for top-mounted ice makers, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation
1 ea	Warranty: 3-Year parts & labor for bin
1 kt	Model HS-2034 Top Kit, 14", ABS
1 kt	Model HS-2032 Top Kit, 4", ABS

ITEM 33A - WATER FILTRATION SYSTEM, FOR ICE MACHINES (1 REQ'D)



Hoshizaki Model H9320-52

Water Filtration System, twin configuration, 19.11" H (manifold & cartridge), NSF

ITEM 34 - SPARE NO.

ITEM 35 - SHELVING (1 lt REQ'D)



Centaur Model SHELVING

Dry Storage Shelving 5-Tier, 86" posts,chromate finish, NSF Sized Per Plan

5 ea	Model C2142C Centaur® Shelving C Series Shelving, wire, 42"W x 21"D, chrome plated finish, NSF
10 ea	Model C2148C Centaur® Shelving C Series Shelving, wire, 48"W x 21"D, chrome plated finish, NSF
10 ea	Model C2154C Centaur® Shelving C Series Shelving, wire, 54"W x 21"D, chrome plated finish, NSF
20 ea	Model C86C Centaur® Stationary Post, 86-5/8"H, with leveling bolt & cap, chrome

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ITEM 36 - BY OTHERS

Soda System - By Others

ITEM 37 - SPARE NO.

ITEM 38 - SPARE NO.

ITEM 39 - SPARE NO.

ITEM 40 - BY OTHERS

Printer - By Others

ITEM 40A - SHELF (2 REQ'D)

INFINITY METAL FABRICATING Model PRINTER SHELVES

custom stainless steel Printer Shelves, 8" x 12" verify with printers. NSF

ITEM 41 - PASS-THRU REFRIGERATOR (3 REQ'D)



Hoshizaki Model PT2A-FG-FS Dimensions: 79.5(h) x 55(w) x 37.75(d)

Steelheart Series Refrigerator, pass-thru, two-section, 52.5 cu. ft., top mounted self-contained refrigeration system, (6) epoxy coated wire shelves, (2) full-height hinged glass doors, digital temperature display/controls, LED interior lighting, stainless steel interior, stainless steel exterior front, sides & top, (4) 4" casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/2 HP, NEMA 5-15P, cETLus, ETL-Sanitation (Made to order)

	Solid Back Doors
3 ea	Warranty: 7-Year labor on entire machine
3 ea	Warranty: 7-Year parts on entire machine
3 ea	Warranty: 7-Year parts on compressor
3 ea	115v/60/1-ph, 8.0 amps, standard
3 pk	Model HS-3550 Shelf, epoxy coated wire, (3) pack, for 1 & 2 section pass-thru refrigerated units
3 pk	Model LP-6 LEG Leg Package, (4) x 6" stainless steel legs

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ITEM 41A - TOE KICK (3 REQ'D)

INFINITY METAL FABRICATING Model TOE KICK

Custom stainless toe kick

ITEM 41B - TRIM (1 REQ'D)

Custom Model TRIM

Custom stainless trim around beverage refrigerators

ITEM 42 - SHELVING (1 lt REQ'D)



Centaur Model SHELVING

Dry Storage Shelving 5-Tier, 86" posts,chromate finish, NSF Sized Per Plan

- 10 ea Model C1842C Centaur® Shelving C Series Shelving, wire, 42"W x 18"D, chrome plated finish, NSF
- 5 ea Model C1848C Centaur® Shelving C Series Shelving, wire, 48"W x 18"D, chrome plated finish, NSF
- 5 ea Model C2430C Centaur® Shelving C Series Shelving, wire, 30"W x 24"D, chrome plated finish, NSF
- 16 ea Model C86C Centaur® Stationary Post, 86-5/8"H, with leveling bolt & cap, chrome

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ITEM 43 - HAND SINK (1 REQ'D)



John Boos Model PBHS-W-1410-SSLR-X

Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, splash mount faucet holes with 4" centers, 1-7/8" drain opening with basket drain, with left & right side splashes, includes mounting bracket, all stainless steel construction, NSF, CSA-Sanitation (faucet NOT included) (Available in Effingham and Nevada)

- 1 ea Fisher Model 19960 Faucet, backsplash mount, 4" centers, 6"H swivel gooseneck spout, 2.2 gpm, check valves, lever handles with color coded indexes, 1/2" NPT male inlets, low lead

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ITEM 44 - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)



Delfield Model 4448NP-18M Dimensions: 44.5(h) x 48.13(w) x 31.5(d)

Mega Top Sandwich/Salad Top Refrigerator, two-section, 48" W, 16.0 cubic feet, (2) doors, (2) 1/1 GN shelves, stainless steel top with polyethylene cutting board & (18) 1/6 size plastic pans, ABS interior sides, stainless steel front & sides, 5" casters, front-breathing rear-mounted refrigeration system, R290 Hydrocarbon refrigerant, 0.3 hp, cUL, UL, NSF

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Model W00007ACN 7 year compressor warranty, standard
- 1 ea 115v/60/1-ph, NEMA 5-15P, standard
- 1 ea Self-contained refrigeration, standard
- 1 ea Door(s) standard
- 1 ea Model 4448COMPM Composite cutting board - 48"

ITEM 45 - STAND (1 REQ'D)

INFINITY METAL FABRICATING Model STAND

Custom s/s stand for Merrychef CONNEX 16
24"X X 30"D X 42"H

ITEM 45A - RAPID COOK OVEN (1 REQ'D)



Merrychef USA Model CONNEX 16 CARBON BLACK

Merrychef conneX® 16, Microwave Convection/Impingement Oven, 2000 watt microwave / 3200 watt convection, ventless, 16" x 16" cooking cavity, EasyTouch™ 2.0 , 7" high definition touchscreen control, bottom-hinged door, built-in catalytic converters, stainless steel finish (1) cook plate (DF0035), (1) paddle (SF326), (1) solid bottom basket (32Z4175), (1) cool down pan (32Z4028), (1) non-stick cooking liner (32Z4178), (1) oven cleaner/protector pack (32Z4148), (1) Scrapper (32Z4191), (1) steam pipe brush (32Z4188), carbon black exterior, cULus, UL EPH Classified

- 1 ea 1 year parts & labor warranty, standard
- 1 ea 208-240v/60/1-ph, 6 foot cord with NEMA 6-30P (X16SBMV6DFL1BKUS), standard

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ITEM 45B - RAPID COOK OVEN (1 REQ'D)



Merrychef USA Model CONNEX 16 CARBON BLACK

Merrychef conneX® 16, Microwave Convection/Impingement Oven, 2000 watt microwave / 3200 watt convection, ventless, 16" x 16" cooking cavity, EasyTouch™ 2.0 , 7" high definition touchscreen control, bottom-hinged door, built-in catalytic converters, stainless steel finish (1) cook plate (DF0035), (1) paddle (SF326), (1) solid bottom basket (32Z4175), (1) cool down pan (32Z4028), (1) non-stick cooking liner (32Z4178), (1) oven cleaner/protector pack (32Z4148), (1) Scrapper (32Z4191), (1) steam pipe brush (32Z4188), carbon black exterior, cULus, UL EPH Classified

- 1 ea 1 year parts & labor warranty, standard
- 1 ea 208-240v/60/1-ph, 6 foot cord with NEMA 6-30P (X16SBMV6DFL1BKUS), standard

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**ITEM 45C - MERRYCHEF ACCESSORIES:

PMS1-X16 PM STANDARD, (1) UNIT

SR320 PADDLE
32Z4113 NON-STICK MOULD
32Z4176 TEFLON TRAY
(2) 32Z4090 HALF SIZE DEEPER COOKING TRAY
(2) 32Z4089 TEFLON BASKET
(2) 32Z4095 TEFLON BASKET
32Z4160 NON-STICK PLATE LINER PURPLE
32Z4096 NON-STICK PLATE LINER GREEN
32Z4032 TEFLON BASKET, WAVEY TRAY
32Z4119 CONTAINER, 1/6 GN

 (1 REQ'D)**

Merrychef USA Model ACCESSORIES

**ITEM 45D - MERRYCHEF ACCESSORIES:

PMS2-X16 PM STANDARD (2ND) UNIT

SR320 PADDLE
32Z4113 NON-STICK MOULD
32Z4176 TEFLON TRAY
(2) 32Z4090 HALF SIZE DEEPER COOKING TRAY
(2) 32Z4089 TEFLON BASKET
(2) 32Z4095 TEFLON BASKET
32Z4160 NON-STICK PLATE LINER PURPLE
32Z4096 NON-STICK PLATE LINER GREEN
32Z4032 TEFLON BASKET, WAVEY TRAY
32Z4119 CONTAINER, 1/6 GN

 (1 REQ'D)**

Merrychef USA Model ACCESSORIES

ITEM 46 - GRIDDLE, GAS, COUNTERTOP (1 REQ'D)



Vulcan Model MSA24 Dimensions: 15.25(h) x 24(w) x 31.5(d)

Heavy Duty Griddle, countertop, gas, 24" W x 24" D cooking surface, 1" thick polished steel griddle plate, embedded mechanical snap action thermostat every 12", millivolt pilot safety, manual ignition, low profile, stainless steel front, sides, front grease trough, 4" back & tapered side splashes, 4" adjustable legs, 54,000 BTU, CSA Star, CSA Flame, NSF

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea Gas type to be specified
- 1 kt Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

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ITEM 47 - HOTPLATE, COUNTERTOP, GAS (1 REQ'D)



Vulcan Model VCRH12-QS-PLATINUM Dimensions: 13.3(h) x 12(w) x 29.3(d)

(Quick Ship) Hotplate, gas, countertop, 12", (2) 25,000 BTU cast iron open burners with lift-off burner heads, infinite heat controls, crumb tray, (1) drawer, stainless steel front, sides & front top ledge, 4" adjustable legs, 50,000 BTU, CSA, NSF

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea Please indicate propane or natural gas while processing your order. Please specify altitude when above 2,000 feet.
- 1 ea Natural gas
- 1 kt Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside

dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

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ITEM 48 - SALAMANDER BROILER, GAS (1 REQ'D)

Vulcan Model 36RB-N Dimensions: 17.63(h) x 36(w) x 19(d)



Salamander Broiler, natural gas, 36" wide, 50,000 BTU heavy duty burner, dual control, (6) grid positions, removable pan, stainless steel front, top & sides, 3/4" gas connection & pressure regulator

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea Wall mount
- 1 ea Model WALLMNT-CHRBKR Wall mount brackets, stainless steel (set) (stainless steel bottom panel required)
- 1 ea Model BOTTOM-SLMNDR Stainless bottom panel (required with wall bracket)
- 1 kt Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

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ITEM 49 - SPARE NO.

ITEM 50 - SPARE NO.

ITEM 51 - COMBI OVEN, GAS (1 REQ'D)

RATIONAL Model ICP 10-HALF NG 120V 1 PH (LM100DG) Dimensions: 39.9(h) x 33.5(w) x 30.5(d)



(CD1GRRA.0000234) iCombi Pro® 10-Half Size Combi Oven, natural gas, (10) 13" x 18" sheet pan or (10) 12" x 20" steam pan or (10) 1/1 GN pan capacity, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 83,500 BTU, 120v/60/1-ph, 6 ft. cord, 0.9 kW, CE, IPX5, cCSAus, NSF, ENERGY STAR®

- 1 ea NOTE: All discounts subject to approval by manufacturer
- 1 ea 2 years parts and labor, 5 years steam generator warranty
- 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 ea Model 9999.2110 Commissioning -one (1) gas iCombi - the operational function test and gas flue analysis when not completed at time of RATIONAL certified installation. Includes 100 miles (200 miles round-trip). THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 1 ea Model 8720.1560US Installation Kit, for gas iCombi/SCC/CMP 101G (120/60/1ph); gas iCombi/SCC/CMP 62G (208-240/60/1ph); gas iCombi/SCC/CMP 61G (120/60/1ph) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 1 ea Model 1900.1154US Water Filtration Single Cartridge System, for any iVario, single Combi model, or XS or half-size Combi-Duos, includes: (1) single head with pressure gauge, R95H filter & filter installation kit
- 1 ea NOTE: The RATIONAL Water Filtration Systems helps provide consistent high quality water to

your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates

1 ea Model 56.01.535 Cleaner tablet Active Green, for all iCombi Pro/Classic, 150 pieces/bucket (minimum order quantity- 2 ea, unless ordered with a unit)

1 ea Model 56.00.562 Care Tablets, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit)

1 ea Model 60.31.103 Stand II Mobile Oven Stand, 27-1/2"H, (14) supporting rails, side panels and top closed, rear panel open, stainless steel construction, height adjustable casters, for iCombi 6- and 10-half size Classic/Pro

1 ea Model 60.75.773 Heat Shield, for left side panel, type 10-half size Pro/Classic

1 ea Model 6035.1017 Gastronorm CombiGrill, 1/1 GN, 12-3/4" x 20-7/8", TriLax® coating

2 ea Model 6014.1106 Gastronorm Container, 1/1 size, 12-3/4" x 20-7/8", 2-1/2" deep, granite enameled

1 ea Model 60.71.617 Grilling & Searing Plate, 1/1 size, 12-3/4" x 20-7/8" (the continuous lip at the back makes it ideal for roasting food that is likely to give off fat or liquid, coated with TriLax coating)

3 ea Model 60.71.157 Multibaker, 1/1 GN, 12-3/4" x 20-7/8", 8 molds, TriLax Coating

1 ea Model 6010.1101 Gastronorm Grid Shelf, 1/1 size, 12-3/4" x 20-7/8", stainless steel

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ITEM 51A - WATER FILTRATION SYSTEM, FOR STEAM EQUIPMENT (1 REQ'D)



3M Purification Model SF165

(5624601) 3M™ Water Filtration Products Water Filtration System, with ScaleGARD™ HT scale control, 3 micron, 125 psi, 3.34 gpm flow rate, 35,000 gallons capacity, reduces sediment, chlorine taste & odor, for high and low-temperature applications, includes: (1) pressure gauge, (1) inlet shut-off valve and (1) outlet check valve, mounting bracket, (1) filter cartridge, & scale-feeding system, 3/4" NPT connections, NSF certified

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ITEM 52 - WORK TABLE, 24", STAINLESS STEEL TOP (1 REQ'D)



John Boos Model ST6R5-3024SSK-X Dimensions: 40.75(h) x 24(w) x 30(d)

Work Table, 24"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD (Available in Effingham and Nevada)

ITEM 53 - SPARE NO.

ITEM 54 - SPARE NO.

ITEM 55 - CHARBROILER, GAS, COUNTERTOP (1 REQ'D)

Vulcan Model VCCB36 Dimensions: 14.75(h) x 36(w) x 27.25(d)



Charbroiler, gas, countertop, 36", (6) 14,500 BTU cast iron burners, infinite heat controls, reversible grates, stainless steel front, sides, top trim, backsplash & grease trough, 4" adjustable legs, 87,000 BTU, CSA, NSF

1 ea 1 year limited parts & labor warranty, standard

1 ea Natural gas (specify elevation if over 2,000 ft.)

1 kt Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

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ITEM 56 - EQUIPMENT STAND, REFRIGERATED BASE (1 REQ'D)

Hoshizaki Model CR72A Dimensions: 27(h) x 72.5(w) x 33.25(d)



Steelheart Series Refrigerated Low-Profile Equipment Stand, two-section, 72-1/2"W x 33-1/4"D x 26"H, (4) drawers: each will accommodate (2) 12" x 20" x 6" deep pans (pans not included), solid state digital controller with temperature alarms, LED display, stainless steel exterior front, sides, & top, stainless steel interior, (6) 4" casters, side-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.0 amps, cord with NEMA 5-15P, cETLus, ETL-Sanitation

1 ea Warranty: 7-Year labor on entire machine

1 ea Warranty: 7-Year parts on entire machine

1 ea Warranty: 7-Year parts on compressor

1 lt PREMIER Model DRAWER RAILS Drawer assembly divider bars

ITEM 57 - HOOD (1 REQ'D)

Captive-Aire Model 6024ND-2-PSP-F



6024ND-2-PSP-F - 12ft 6" Long Exhaust-Only Wall Canopy Hood with 20" Wide Front Perforated Supply Plenum with Built-in 3" Back Standoff
- 430 SS Where Exposed
- Insulation for the PSP Housing - Front
- Fire Cabinet on the Left Side 12.00" Width x 60.00" Length x 24.00" Height (Additional charges may apply for cabinet if not sold with fire system)
- FILTER - 20" tall x 16" (19.625" by 15.625") wide Stainless Steel Captrate Solo filter with hook, ETL Listed. Particulate capture efficiency: 85% efficient at 9 microns, 76% efficient at 5 microns. Used on hoods shipped AFTER 7/27/17.
- L55 Series E26 Canopy Light Fixture - High Temp Assembly, Includes Clear Thermal and Shock Resistant Globe (L55 Fixture), Bulbs By Others
- Extra Fixtures- L55 Series E26 Canopy Light Fixture - High Temp Assembly, Includes Clear Thermal and Shock Resistant Globe (L55 Fixture)
- EXHAUST RISER - Factory installed 14" Diameter X 4" Height
- SUPPLY RISER - 12"x 28" Supply Riser with Volume Dampers
- 1/2 Pint Grease Cup New Style, Flanged Slotted
- Electrical Package Installation in Utility Cabinet by Plant.
- RIGHT END STANDOFF (FINISHED) 1" Wide 60" Long Insulated
- STRUCTURAL FRONT PANEL
- INSULATION FOR BACK OF HOOD
- LEFT VERTICAL END PANEL 27" Top Width, 21" Bottom Width, 80" High Insulated 430 SS
- RIGHT WALL AS END PANEL

1 ea Model HOOD ACCESSORIES - FIELD WRAPPER 18.00" High Front, Left

- BACKSPLASH 122.00" High X 181.00" Long 430 SS Vertical (Back) (Includes End Caps & Divider Bars)

- RIGHT SIDESPLASH 122.00" High X 78.00" Long 430 SS Vertical (Right) (Includes End Caps & Divider Bars)

1 ea Model FACTORY SERVICES Service Design Verification for Hood

Service Design Verification for Site Meeting w/ additional mileage charge.

Service Design Verification for Standard Electrical Control Package

Service Design Verification for TANK Fire Suppression

Service Design Verification Mileage Charge

1 ea Model FREIGHT Freight to site

ITEM 57A - HOOD CONTROLS (1 REQ'D)

Captive-Aire Model HOOD CONTROLS

Hood Controls - Touch Screen

ITEM 58 - FIRE SYSTEM (1 REQ'D)

Captive-Aire Model FIRE SYSTEM

TANK-SP-3 Tank Fire Suppression 12 gallon Fire System in Utility Cabinet (includes pre-piped hood(s) with electric detection, tank(s), 24 VDC release mechanism, fire system agent, pressurized tanks, and electric pull station).
Includes piping for hood: 2.
- Pressure Switch - Monitors Tank Pressure, Supervised Signal, TANK FIRE SUPPRESSION
- Tank-based Fire Protection System equipped with Electronic Detection utilizing CORE board as a Listed Release Mechanism. Installed in Hood Utility Cabinet with integral hood prewire panel.
- Includes Final Field Connections and (1) Electric Gas Valve – Verify Size, Max. 2”. Electric Gas Valve is to be Installed by the Plumber Near the Hood Cooking Line.
Note: Customer is responsible for additional labor charges as a result of cooking equipment layout changes after the release of the order, union labor charges, or additional trips by fire system distributor caused by jobsite delays, permits, fees or test required by local authority. Submittal will specify applicable testing and approval agencies. Does Not Include Hand Held Extinguishers. Any audible or visual indicators required by local code is not included and is to be provided by others.
DOES NOT INCLUDE UNION LABOR

ITEM 59 - HEAT SENSOR (1 REQ'D)

Captive-Aire Model SC-011110MA

SC-011110MA Starter Coil Control Only w/ control for 1 Exhaust Fan, 1 Supply Fan, Exhaust on in Fire, Lights out in Fire, Relay On/Off with Supply Fan, Fan(s) On/Off Thermostatically Controlled. Room temperature sensor shipped loose for field installation. Includes 2 Duct Thermostat kits.
- CAT-5E CABLE - 15 Foot.
- Thermistor CABLE - 18/2 AWG GREEN WHITE, plenum rated. USED for thermistor duct stat. Per Foot Price.
- Digital Prewire Lighting Relay Kit. Includes hood lighting relay & terminal blocks. Allows for up to 1400W of lighting each.

ITEM 60 - OVERSHELF (1 REQ'D)

INFINITY METAL FABRICATING Model DOUBLE OVERSHELF

Custom 54" x 24" Double Overshelf With Shoe Box Style Plywood Core, Provision For 30" Heat Lamp

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ITEM 61 - HEAT LAMP (1 REQ'D)



Hatco Model GRAH-36D3 Dimensions: 2.5(h) x 36(w) x 15(d)

Glo-Ray® Infrared Strip Heater, 36" W, high wattage, tubular metal heater rod, double heater rod housing 3" spacing, aluminum construction, 1600 watts, NSF, cULus, Made in USA

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Glo-Ray metal sheathed elements
- 1 ea 120v/60/1-ph
- 1 ea Model BLT TOG-1 (1) Built-in toggle control (remote recommended) (available at time of purchase only)
- 1 ea Model LEADS5 1'-5' Extended Electrical Leads (available at time of purchase only)
- 1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM 62 - SPARE NO.

ITEM 63 - REFRIGERATED WORK TOP (1 REQ'D)



Delfield Model 4448NP-A563 Dimensions: 36(h) x 48(w) x 31.5(d)

Refrigerated Worktop/Undercounter, two-section, 48"W, (2) doors

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Model W00007ACN 7 year compressor warranty, standard
- 1 ea 115v/60/1-ph, NEMA 5-15P, standard
- 1 ea Self-contained refrigeration, standard
- 1 ea Door(s) standard

ITEM 64 - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)



Delfield Model 4448NP-18M Dimensions: 44.5(h) x 48.13(w) x 31.5(d)

Mega Top Sandwich/Salad Top Refrigerator, two-section, 48" W, 16.0 cubic feet, (2) doors, (2) 1/1 GN shelves, stainless steel top with polyethylene cutting board & (18) 1/6 size plastic pans, ABS interior sides, stainless steel front & sides, 5" casters, front-breathing rear-mounted refrigeration system, R290 Hydrocarbon refrigerant, 0.3 hp, cUL, UL, NSF

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Model W00007ACN 7 year compressor warranty, standard
- 1 ea 115v/60/1-ph, NEMA 5-15P, standard
- 1 ea Self-contained refrigeration, standard
- 1 ea Door(s) standard
- 1 ea Model 4448COMPM Composite cutting board - 48"

ITEM 65 - BY OTHERS

Sneeze Guard - By Others

ITEM 66 - BY OTHERS

Printer - By Others

ITEM 67A - WORK TABLE (1 REQ'D)

INFINITY METAL FABRICATING Model WORK TABLE

Custom s/s worktable w/ base, approx. 24", per plan, undershelf

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ITEM 67B - WORK TABLE (1 REQ'D)

INFINITY METAL FABRICATING Model WORK TABLE

Custom s/s worktable w/ base, approx. 24", per plan, undershelf

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ITEM 68A - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)

Delfield Model 4448NP-18M-A5 Dimensions: 44.5(h) x 48.13(w) x 31.5(d)



Mega Top Sandwich/Salad Top Refrigerator, two-section, 48" W, 16.0 cubic feet, (2) doors, (2) 1/1 GN shelves, stainless steel top with polyethylene cutting board & (18) 1/6 size plastic pans, ABS interior sides, stainless steel front & sides, 5" casters, front-breathing rear-mounted refrigeration system, R290 Hydrocarbon refrigerant, 0.3 hp, cUL, UL, NSF

LIFT OFF COVERS

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Model W00007ACN 7 year compressor warranty, standard
- 1 ea 115v/60/1-ph, NEMA 5-15P, standard
- 1 ea Self-contained refrigeration, standard
- 1 ea Door(s) standard
- Lift off covers
- 1 ea Model 4448COMPM Composite cutting board - 48"

ITEM 68B - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)

Delfield Model 4472NP-30M-A5 Dimensions: 44.5(h) x 72.13(w) x 31.5(d)

Mega Top Sandwich/Salad Top Refrigerator, three-section, 72" W, 24.80 cubic feet, (3) doors, (3) 1/1 GN shelves, stainless steel top with polyethylene cutting board & (30) 1/6 size plastic pans, ABS interior sides, stainless steel front & sides, 5" casters, front-breathing rear-mounted refrigeration system, R290 Hydrocarbon refrigerant, 0.35 hp, cUL, UL, NSF

LIFT OFF COVERS

- 1 ea Model 0460003CN 3 year parts & labor warranty, standard
- 1 ea Model W00007ACN 7 year compressor warranty, standard
- 1 ea 115v/60/1-ph, NEMA 5-15P, standard
- 1 ea Self-contained refrigeration, standard
- 1 ea Door(s) standard
- Lift off covers
- 1 ea Model 4472COMPM Composite cutting board - 72"

ITEM 69 - WORK TABLE WITH PROVISION FOR DROP IN HOT WELL (1 REQ'D)

INFINITY METAL FABRICATING Model WORK TABLE

Custom s/s worktable w/base, approx. 3' 6" per plan, provisions for drop-in, undershelf

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ITEM 70 - HOT FOOD WELL UNIT, DROP-IN, ELECTRIC (1 REQ'D)

Alto-Shaam Model 200-HWILF/D6 Dimensions: 9.25(h) x 31.25(w) x 27.06(d)



Halo Heat® Hot Food Well Unit with large flange, Drop-In, Electric, (2) 12" x 20" full-size pan capacity (pans NOT included), 6-3/8" deep well, holds 6" deep pans, includes (4) third-size pan divider bars, (2) individual adjustable thermostatic controllers, stainless steel construction, EcoSmart®, cULus, UL EPH, Classified, CE, IPX3, TUV NORD

- 1 ea NOTE: Subject to Manufacturer's Terms & Conditions. See Documents Section
- 1 ea 120v/50/60/1-ph, 10.0 amps, 1.2kW, 6 ft. cord, NEMA 5-15P, standard
- 1 ea Cord located on bottom of control box

ITEM 71-72 - SPARE NO.

ITEM 73 - WORK TABLE, 36", STAINLESS STEEL TOP (1 REQ'D)

John Boos Model ST6R5-3636SSK Dimensions: 40.75(h) x 36(w) x 36(d)



Work Table, 36"W x 36"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

ITEM 74 - SHELF, WALL-MOUNTED (1 lt REQ'D)

John Boos Model WALL SHELF



Wall Shelf With Brackets as follows:.

- 1 ea Model EWS8-1248-X Shelf, wall-mounted, 48"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)
- 1 ea Model EWS8-1648-X Shelf, wall-mounted, 48"W x 16"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 74A - SHELF, WALL-MOUNTED (1 lt REQ'D)

John Boos Model WALL SHELF



Wall Shelf With Brackets as follows:.

- 1 ea Model EWS8-1236-X Shelf, wall-mounted, 36"W x 12"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)
- 1 ea Model EWS8-1636-X Shelf, wall-mounted, 36"W x 16"D, Stallion Safety Edge front, 1-1/2"H rear up-turn, includes (2) support brackets, 18/430 stainless steel with # 4 polish, KD, NSF (Available in Effingham)

ITEM 75 - FOOD PAN WARMER, COUNTERTOP (1 REQ'D)



Vollrath Model 71001 Dimensions: 9(h) x 21.75(w) x 13.75(d)

Cayenne® Food Warmer, countertop, full size, 13-3/4"W x 21-3/4"D x 9"H, 6" deep well, recessed controls, capillary tube thermostat, dome heating element, low-water indicator light, black interior, stainless steel exterior, non-skid feet, 120v/60/1-ph, 700 watts, 5.8 amps, cord, NEMA 5-15P, cULus, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

ITEM 76 - HEATED HOLDING PROOFING CABINET, MOBILE (1 REQ'D)



Vulcan Model VP18 Dimensions: 71(h) x 25.25(w) x 30.75(d)

Proofing Heated Cabinet, mobile, non-insulated, (18) 18" x 26" x 1" sheet pans or (36) 12" x 20" x 2-1/2" steam table pans, fan & air tunnel, includes (10) pair of adjustable tray slides 3" OC, 1/2 gallon water pan, switch can be set to proof or set for heated holding up to 190° F, glass door, stainless steel construction, includes drip trough & removable drip pan, 5" casters; 2 swivel, 2 rigid with locks, 120v/50/60/1-ph, 2.0kW, cord with NEMA 5-20P, cULus, UL EPH

ITEM 77 - SPARE NO.

ITEM 78 - REFRIGERATED WORK TOP (1 REQ'D)



Delfield Model 4448NP Dimensions: 36(h) x 48(w) x 31.5(d)

Refrigerated Worktop/Undercounter, two-section, 48"W, (2) doors

1 ea	Model 0460003CN 3 year parts & labor warranty, standard
1 ea	Model W00007ACN 7 year compressor warranty, standard
1 ea	115v/60/1-ph, NEMA 5-15P, standard
1 ea	Self-contained refrigeration, standard
1 ea	-NN: 32" work height
1 ea	Door(s) standard

ITEM 79 - SHAKE MACHINE (2 REQ'D)



Stoelting Model E122-38I2 Dimensions: 35.5(h) x 19.75(w) x 30(d)

Frozen Beverage/Shake Machine, counter top, 19-3/4"W x 30"D x 35-1/2"H, air cooled, (2) flavors, gravity, IntelliTec2™ control with LCD display, (2) 12 quart hopper, (2) 5 quart freezing cylinder, (1) selector switch, auto-off clean, low mix light, USB connection, filtered bottom air inlet for side-by-side installation, 6,000 BTU/hr compressor air, (2) 1/3 hp motors, 5500 BTU/hr, 208-240v/60/1-ph, cord with NEMA 6-15P, 11 amps, UL, cUL, NSF (Mix inlet regulator required)

2 ea	1 year parts & labor warranty, standard (North America Only)
2 ea	5 year warranty on compressor, evaporator/hopper assembly, drive motor, speed reducer, auger shaft & auger flights (against breakage) standard
2 ea	Model 3SUF Startup

ITEM 80 - REFRIGERATED WORK TOP (1 REQ'D)



Delfield Model D4448NP Dimensions: 36(h) x 48(w) x 31.5(d)

Refrigerated Worktop/Undercounter, two-section, 48"W, (4) drawers

1 ea	Model 0460003CN 3 year parts & labor warranty, standard
1 ea	Model W00007ACN 7 year compressor warranty, standard
1 ea	115v/60/1-ph, NEMA 5-15P, standard
1 ea	Self-contained refrigeration, standard

1 ea -NN: 32" work height
1 lt PREMIER Model DRAWER RAILS Drawer assembly divider bars

ITEM 81 - SPARE NO.

ITEM 82 - SPARE NO.

ITEM 83 - AIR CURTAIN (1 REQ'D)

Mars Air Systems Model STD236-1UA-OB Dimensions: 10.62(h) x 36(w) x 12.75(d)



Standard Series 2 air curtain for 36"W door, unheated, galvanized steel cabinet with Obsidian Black powder coat finish, (1) 1/2 HP motor, 115v/60/1-ph, 500 watts, 5.1 amps, cETLus

1 ea 5 year warranty, standard
1 ea Model 99-014 Door limit switch, plunger/roller type for indoor applications, single pole double throw, 1 HP max, 250v, 20.0 amps, NEMA 1 (remote mounted)

ITEM 83A - CONTROLLER KIT (1 REQ'D)

Mars Air Systems Model J0021

Controller kit with adjustable time delay (6s - 20min) and commercial plastic surface mounted magnetic reed switch, 1/2 HP max, 115v/1-ph

1 ea Model 99-018 Magnetic reed switch, commercial plastic body for surface mounted applications, 24v, NEMA 1 (requires controller, or motor control panel wth MCP-24v)

ITEM 84 - BY OTHERS

POS Printer- By Others

ITEM 84A - SHELF (1 REQ'D)

INFINITY METAL FABRICATING Model PRINTER SHELVES

custom stainless steel Printer Shelves, 8" x 12" verify with printers. NSF

ITEM 85 - ICE & WATER DISPENSER (1 REQ'D)



Delfield Model 204 Dimensions: 22.6(h) x 24(w) x 21(d)

Ice & Water Unit, Drop-In, single service, glass filler, insulated ice chest, 45 pound ice storage capacity, chrome plated wire strainer, lift-off cover with handle, stainless steel top, galvanized steel exterior tank, (21" x 17-3/4" cutout required), NSF

ITEM 86 - SPARE NO.

ITEM 87 - DISPOSABLE CUP DISPENSER (6 REQ'D)



Carlisle Model C2210C18 Dimensions: 18(w)

San Jamar - Euro EZ-Fit® Cup Dispenser, in-counter mount, 18"L tube, 6 to 24 oz. paper/plastic/foam cups with rim diameter of 2-7/8" to 3-7/8", vertical or horizontal, high-impact plastic, NSF

ITEM 88 - STAINLESS STEEL CABINETS (1 REQ'D)

INFINITY METAL FABRICATING Model BASE CABINETS

Custom Stainless Worktable w/ Sink and side splashes, approx. 11', Stainless steel doors per plan, cup dispenser, 6" stainless steel legs, doors, Provision for plumbing and electrical access and connections. Per plan. Field verify. NSF

1 ea Fisher Model 35150 Faucet, deck mount, 4" centers, 12" swivel gooseneck spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, ADA Compliant

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ITEM 89 - OVERSHELF (1 REQ'D)

INFINITY METAL FABRICATING Model DOUBLE OVERSHELF

Custom 48" x 24" Double Overshelf With Shoe Box Style Plywood Core, Provision For 30" Heat Lamp

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ITEM 89A - HEAT LAMP (1 REQ'D)



Hatco Model GRAH-36D3 Dimensions: 2.5(h) x 36(w) x 15(d)

Glo-Ray® Infrared Strip Heater, 36" W, high wattage, tubular metal heater rod, double heater rod housing 3" spacing, aluminum construction, 1600 watts, NSF, cULus, Made in USA

1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details

1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350

1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Glo-Ray metal sheathed elements

1 ea 120v/60/1-ph

1 ea Model BLT TOG-1 (1) Built-in toggle control (remote recommended) (available at time of purchase only)

1 ea Model LEADS5 1'-5' Extended Electrical Leads (available at time of purchase only)

1 ea Model STANDARD Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

ITEM 90 - SPARE NO.

ITEM 91 - TEA BREWER - BY OTHERS

Tea Brewer - By Others

ITEM 91A - FILTER - BY OTHERS

Filter - By Others

ITEM 101 - BY OTHERS

Countertop & Millwork - By Others

ITEM 101A - SHELVING (1 lt REQ'D)



Centaur Model SHELVING

Dry Storage Shelving 5-Tier, 86" posts,chromate finish, NSF Sized Per Plan

3 ea Model C2430C Centaur® Shelving C Series Shelving, wire, 30"W x 24"D, chrome plated finish, NSF

4 ea Model C33C Centaur® Stationary Post, 34-1/2"H, with leveling bolt & cap, chrome
Cut down to 27"

ITEM 102 - DISPLAY CASE (1 REQ'D)

Premier Metal & Glass Model TMTUD

Custom bakery display case
INFINITY UV BONDED TWO TIER DISPLAY CASE WITH REAR SLIDING DOORS; 1/2" CLEAR TEMPERED GLASS WITH POLISHED EDGES; BOTH END PANELS INCLUDED; SURFACE MOUNTING OPTION WITH Z-CLIPS; NO HEAT/LIGHT INCLUDED; BRUSHED STAINLESS FINISH; APPROX 36" CL LENGTH;

1 ea Model CRATING Manufacture crating charge.

ITEM 103 - BY OTHERS

POS Machine - By Others

ITEM 104 - STAINLESS STEEL WORK TABLE (1 REQ'D)

INFINITY METAL FABRICATING Model WORK TABLE

Custom Stainless Steel Support Stand, approx. 9', w/ cup dispenser (3) holder, 32 3/4" high, 28" deep. For coffee area. Per plans. NSF

ITEM 105 - BY OTHERS

Printer - By Others

ITEM 106 - ESPRESSO MACHINE - BY OTHERS

Espresso Machine - By Others

ITEM 106A - FILTER - BY OTHERS

Filter - By Others

ITEM 107 - GRINDER - BY OTHERS

Grinder - By Others

ITEM 108 - KNOCK BOX - BY OTHERS

Knock Box - By Others

ITEM 109 - REFRIGERATED WORK TOP (1 REQ'D)



Delfield Model 4448NP-NN Dimensions: 36(h) x 48(w) x 31.5(d)

Refrigerated Worktop/Undercounter, two-section, 48"W, (2) doors

1 ea	Model 0460003CN 3 year parts & labor warranty, standard
1 ea	Model W00007ACN 7 year compressor warranty, standard
1 ea	115v/60/1-ph, NEMA 5-15P, standard
1 ea	Self-contained refrigeration, standard
1 ea	-NN: 32" work height
1 ea	Door(s) standard

ITEM 110 - COFFE BREWER - BY OTHERS

Coffee Brewer - By Others

ITEM 111 - GARBAGE - BY OTHERS

Garbage - By Others

ITEM 112 - DISPOSABLE CUP DISPENSER (3 REQ'D)



Carlisle Model C2210C18 Dimensions: 18(w)

San Jamar - Euro EZ-Fit® Cup Dispenser, in-counter mount, 18"L tube, 6 to 24 oz. paper/plastic/foam cups with rim diameter of 2-7/8" to 3-7/8", vertical or horizontal, high-impact plastic, NSF

ITEM 113 - BY OTHERS

Sneeze Guard - By Others

ITEM 114 - BY OTHERS

Stone Countertop - By Others

ITEM 114A - STAINLESS STEEL CABINETS (1 REQ'D)

INFINITY METAL FABRICATING Model BASE CABINETS

Custom Stainless Steel enclosed cabinet countertop support. Per plan. Field verify. NSF

ITEM 114B - STAINLESS STEEL CABINETS (1 REQ'D)

INFINITY METAL FABRICATING Model BASE CABINETS

Custom Stainless Steel Base Cabinet 36", Stainless steel doors per plan, 6" stainless steel legs, door, provision in top for drop in. Provision for plumbing and electrical access and connections. Per plan. Field verify. NSF
COORDINATE DOOR HEIGHT W/COUNTER FRONT EDGE, UPDATE BASE

ITEM 114C - STAINLESS STEEL CABINETS (1 REQ'D)

INFINITY METAL FABRICATING Model BASE CABINETS

Custom Stainless Steel Base Cabinet 9', Stainless steel doors per plan, 6" stainless steel legs, door, provision in top for drop in. Provision for plumbing and electrical access and connections. Per plan. Field verify. NSF
COORDINATE DOOR HEIGHT W/COUNTER FRONT EDGE, UPDATE BASE

ITEM 114D - STAINLESS STEEL CABINETS (1 REQ'D)

INFINITY METAL FABRICATING Model BASE CABINETS

Custom Stainless Steel Base Cabinet 6', Stainless steel doors per plan, 6" stainless steel legs, door, provision in top for drop in. Provision for plumbing and electrical access and connections. Per plan. Field verify. NSF
COORDINATE DOOR HEIGHT W/COUNTER FRONT EDGE, UPDATE BASE

ITEM 115 - SPARE NO.

ITEM 116 - DROP-IN SINK (2 REQ'D)



John Boos Model PB-DISINK101410-SSLR

Pro-Bowl Drop-In Sink, 1-compartment, 12-5/8"W x 18-1/2"D x 16"H overall size, (1) 10"W x 14" front-to-back x 10"deep bowl, deck mount faucet holes with 4" centers, 3-1/2" drain opening with basket drain, stainless steel construction construction, with left & right side splashes, (faucet not included), NSF, CSA-Sanitation

2 ea Fisher Model 35150 Faucet, deck mount, 4" centers, 12" swivel gooseneck spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, ADA Compliant

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ITEM 117 - ICE & WATER DISPENSER (1 REQ'D)



Delfield Model 204 Dimensions: 22.6(h) x 24(w) x 21(d)

Ice & Water Unit, Drop-In, single service, glass filler, insulated ice chest, 45 pound ice storage capacity, chrome plated wire strainer, lift-off cover with handle, stainless steel top, galvanized steel exterior tank, (21" x 17-3/4" cutout required), NSF

ITEM 118 - BY OTHERS

Dry Toppings - By Others

ITEM 119 - BLENDER, BAR (2 REQ'D)



Blendtec Model S885C2901-B1GB1D Dimensions: 17.3(h) x 8.6(w) x 9(d)

Stealth 885™ Countertop Blender Package, with noise reduction, (2) 90 oz WildSide™ jars with measurements up to 48 oz., includes: soft lids, large 4" wingtip blades, BPA Free Eastman Tritan™ containers, 42 pre-programmed blend cycles, capacitive-touch controls with 6 programmable buttons, pulse and manual speed slider, USB port, removable Stealth™ sound enclosure, 3.8 HP (peak), 15 amp/1800 watt direct drive motor, 120v/50/60/1-ph, black, ETL, NSF

1 pk Model 40-209-01-SRV (HardLid-BL) Hard Lid, makes air tight seal, to be used on jars within sound enclosures, black, fits both Wildside+ & Fourside jars (10 per pack)

ITEM 120 - BY OTHERS

Printer - By Others

ITEM 120A - SHELF (1 REQ'D)

INFINITY METAL FABRICATING Model PRINTER SHELVES

custom stainless steel Printer Shelves, 8" x 12" verify with printers. NSF

ITEM 121 - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)



Delfield Model 4448NP-18M-A1548 Dimensions: 44.5(h) x 48.13(w) x 31.5(d)

Mega Top Sandwich/Salad Top Refrigerator, R290 two-section, 48" W, 16.0 cubic feet, composite cutting board

1 ea Model 0460003CN 3 year parts & labor warranty, standard
1 ea Model W00007ACN 7 year compressor warranty, standard
1 ea 115v/60/1-ph, NEMA 5-15P, standard
1 ea Self-Contained refrigeration, standard
1 ea Door(s) standard

ITEM 122 - DROP-IN SINK (1 REQ'D)



John Boos Model PB-DISINK101410-SSLR

Pro-Bowl Drop-In Sink, 1-compartment, 12-5/8"W x 18-1/2"D x 16"H overall size, (1) 10"W x 14" front-to-back x 10"deep bowl, deck mount faucet holes with 4" centers, 3-1/2" drain opening with basket drain, stainless steel construction construction, with left & right side splashes, (faucet not included), NSF, CSA-Sanitation

1 ea Fisher Model 35150 Faucet, deck mount, 4" centers, 12" swivel gooseneck spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, ADA Compliant

ITEM 123 - DISHWASHER, UNDERCOUNTER (1 REQ'D)



Jackson WWS Model DISHSTAR ADA-SEER Dimensions: 29.75(h) x 24.25(w) x 26.88(d)

DishStar® ADA-SEER Dishwasher, undercounter, 24-1/4"W x 26-7/8"D x 29-3/4"H, high temperature sanitizing, ADA-compliant, built-in booster with Sani-Sure™ final rise system, steam elimination & energy recovery system, soft start, approximately (24) racks or (600) dishes/hour, built-in dispensing pumps with automatic prime, delime cycle, digital LED temperature display, solid state controls, auto-fill, push-button start, pressure regulator, automatic pumped drain, water hammer arrestor, includes (1) peg rack & (1) combination rack, stainless steel construction, cETLus, ETL-Sanitation, ENERGY STAR®

1 ea	1 year parts & labor warranty, continental USA, standard
1 ea	208v/60/1-ph, 26.3 amps, 3/4 HP
1 ea	Model 06401-004-59-11 Drain Water Tempering Kit (Delta HT-E-SEER models)
1 st	Model 05700-002-37-82 Casters, set of (4), adds an additional 3/4” to the height of the unit (DishStar® models and Delta HT-E-SEER without stand)

ITEM 124 - REFRIGERATED WORK TOP (1 REQ'D)



Delfield Model D4448NP Dimensions: 36(h) x 48(w) x 31.5(d)

Refrigerated Worktop/Undercounter, two-section, 48"W, (4) drawers

1 ea	Model 0460003CN 3 year parts & labor warranty, standard
1 ea	Model W00007ACN 7 year compressor warranty, standard
1 ea	115v/60/1-ph, NEMA 5-15P, standard
1 ea	Self-contained refrigeration, standard
1 ea	-NN: 32" work height
1 lt	PREMIER Model DRAWER RAILS Drawer assembly divider bars

ITEM 125 - SPARE NO.

ITEM 126 - DISPOSABLE CUP DISPENSER (3 REQ'D)



Carlisle Model C2210C18 Dimensions: 18(w)

San Jamar - Euro EZ-Fit® Cup Dispenser, in-counter mount, 18"L tube, 6 to 24 oz. paper/plastic/foam cups with rim diameter of 2-7/8" to 3-7/8", vertical or horizontal, high-impact plastic, NSF

ITEM 201 - STONE BAR COUNTERTOP - BY OTHER

Stone Bar Countertop - By Others

ITEM 202 - STAINLESS DRINK RAIL W INSTALL (1 REQ'D)

Custom Model DRINK RAIL

Custom Stainless Drink Rail including field dimensioning and installation

ITEM 203 - WASTE CABINET (1 REQ'D)



Perlick Corporation Model TS12DS Dimensions: 36.5(h) x 12(w) x 18.56(d)

TS Series Underbar Wet Waste Sink Unit, 12"W x 18-9/16"D, 10" wide x 14" front-to-back x 9-1/4" deep 18 gauge stainless steel sink, backsplash, 4" OC splash mount faucet holes, 1-1/2" NPS male drain, stainless steel construction, Perlick Quick Clamp tool less leg attachment, stainless steel legs with 1" adjustable thermoplastic feet (replaces TS12HS)

- 1 ea 4" Backsplash in lieu of standard 6" splash
- 1 ea Model 934GN-LF Front Loading Faucet, wall/splash mount, lead free, gooseneck spout, faucet valves includes: built-in check valves to prevent back flow or across flow, (2) 3/8" O.D. x 3/8" O.D. x 18", braided stainless steel supply lines included
- 1 ea Model 7055-48 Perforated Wet Waste Pan, 7 quart capacity, stainless steel (10-3/8" x 12-3/4" x 4" deep)

ITEM 204 - GLASSWASHER, UNDERCOUNTER / UNDERBAR (1 REQ'D)



Moyer Diebel Model DF Dimensions: 39(h) x 25.25(w) x 25.13(d)

Glasswasher, rotary, 25" cabinet, low temperature chemical sanitizing, (1200) 2-1/2" diameter glasses/hr, 12" glass clearance, polypropylene conveyor with clockwise rotation, upper & lower wash/rinse arms, (3) built-in chemical pumps, fully automatic, cool water rinse, built-in mixing valve, cabinet base with door, stainless steel construction, 3.0 kW tank heater, NSF, cETLus, CSA (includes: authorized factory start-up)

- 1 ea 1 year parts & labor warranty, standard
- 1 ea 208-230v/60/1

ITEM 205 - POS PRINTER - BY OTHER

POS Printer - By Others

ITEM 206 - SPARE NO.

ITEM 207 - GARBAGE - BY OTHERS

Garbage - By Others

ITEM 208 - HAND SINK (1 REQ'D)



Perlick Corporation Model TSF12HS Dimensions: 36.5(h) x 12(w) x 22.25(d)

TSF Series Underbar Hand Sink Unit, 12"W x 24"D, 10" wide x 14" front-to-back x 9-1/4" deep 18 gauge stainless steel sink, backsplash, 4" OC splash mount faucet holes, (16) oz. pump soap dispenser integrated into front apron, C-fold paper towel dispenser integrated into front apron, stainless steel hinged door with magnetic catches, 1-1/2" NPS male drain, stainless steel construction, Perlick Quick Clamp tool less leg attachment, stainless steel legs with 1" adjustable thermoplastic feet (replaces TS12HSN)

- 1 ea 4" Backsplash in lieu of standard 6" splash

2 ea Model 1039805 Perlick Flex Mount Leg Relocation Kit, Includes: (1) Rails, (1) Bolts, and (1)Tightening Knobs

1 ea Model 934GN-LF Front Loading Faucet, wall/splash mount, lead free, gooseneck spout, faucet valves includes: built-in check valves to prevent back flow or across flow, (2) 3/8" O.D. x 3/8" O.D. x 18", braided stainless steel supply lines included

1 ea Model 7054R End Splash, right, 6", for TS or TSF series

1 ea Model 7054L End Splash, left, 6", for TS or TSF series

ITEM 209 - DRAINBOARD (1 REQ'D)



Perlick Corporation Model TS24DB Dimensions: 36.5(h) x 24(w) x 18.56(d)

TS Series Underbar Drainboard, 24"W x 18-9/16"D, pitched drainboard top, all stainless steel construction, backsplash, Perlick Quick Clamp tool less leg attachment, stainless steel legs with adjustable thermoplastic feet (replaces TS24)

1 ea 4" backsplash

1 ea Model 1040635-24 TS Series 24"W Perforated Drainboard Insert, 'Stadium' shaped perforations, stainless steel construction, factory installed

1 ea Model SR-D24A Speed Rail, double, 24" W, stainless steel construction, factory installed

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ITEM 210 - SPARE NO.

ITEM 211 - ICE BIN (1 REQ'D)



Perlick Corporation Model TS30IC10 Dimensions: 36.5(h) x 30(w) x 18.56(d)

TS Series Underbar Ice Bin/Cocktail Unit, modular with cold plate, 30"W x 18-9/16"D, approximately 70-lb. ice capacity, 10-circuit aluminum cold plate concealed under bin liner, 6"H backsplash with 1" return at top, ABS plastic top ledge, 10-3/4" deep stainless steel ice bin, stainless steel front & sides, galvanized steel back & bottom, 1/2" NPS male drain, 1-5/8" tubular stainless steel legs with 1" adjustable thermoplastic feet, NSF

1 ea 4" Backsplash in lieu of standard 6" splash

1 ea Model ICC30 Ice Chest Covers, 2-piece sliding assembly, 30"W, front & back, stainless steel (for TS, TSD, & TSS ice chests)

1 ea Model SR-D30A Speed Rail, double, 30" W, stainless steel construction, factory installed

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ITEM 212 - SODA GUN - BY OTHER

Soda Gun - By Others

ITEM 213 - SODA GUN FILLER SECTION (1 REQ'D)

Perlick Corporation Model TS4SGB Dimensions: 22(h) x 4(w) x 18.56(d)

TS Series Soda Gun Filler Section, 4"W x 18-9/16"D x 22"H, all stainless steel construction, universal design accepts either Wunder-Bar® & Schroeder America™ 8-14 product soda manifolds & drip cups (accepts only NON-FLOW CONTROL manifolds that don't exceed 3" in overall thickness), interior mounted manifold conceals soda lines, tool-less removal of top cover provides easy access, integrated drip cup mounting allows concealed routing of drip tube to waste drain, accessory speed rails can bypass or terminate on Soda Gun Filler, soda manifold, hose gun & drip cup NOT included, NSF

ITEM 214 - DRAINBOARD (1 REQ'D)



Perlick Corporation Model TS24DB Dimensions: 36.5(h) x 24(w) x 18.56(d)

TS Series Underbar Drainboard, 24"W x 18-9/16"D, pitched drainboard top, all stainless steel construction, backsplash, Perlick Quick Clamp tool less leg attachment, stainless steel legs with adjustable thermoplastic feet (replaces TS24)

- 1 ea 4" backsplash
- 1 ea Model 1040635-24 TS Series 24"W Perforated Drainboard Insert, 'Stadium' shaped perforations, stainless steel construction, factory installed
- 1 ea Model SR-D24A Speed Rail, double, 24" W, stainless steel construction, factory installed

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ITEM 215-217 - SPARE NO.

ITEM 218 - DRAINBOARD (1 REQ'D)



Perlick Corporation Model TS24DB Dimensions: 36.5(h) x 24(w) x 18.56(d)

TS Series Underbar Drainboard, 24"W x 18-9/16"D, pitched drainboard top, all stainless steel construction, backsplash, Perlick Quick Clamp tool less leg attachment, stainless steel legs with adjustable thermoplastic feet (replaces TS24)

- 1 ea 4" backsplash
- 1 ea Model 1040635-24 TS Series 24"W Perforated Drainboard Insert, 'Stadium' shaped perforations, stainless steel construction, factory installed
- 1 ea Model SR-D24A Speed Rail, double, 24" W, stainless steel construction, factory installed

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ITEM 219 - ICE BIN (1 REQ'D)



Perlick Corporation Model TS30IC10 Dimensions: 36.5(h) x 30(w) x 18.56(d)

TS Series Underbar Ice Bin/Cocktail Unit, modular with cold plate, 30"W x 18-9/16"D, approximately 70-lb. ice capacity, 10-circuit aluminum cold plate concealed under bin liner, 6"H backsplash with 1" return at top, ABS plastic top ledge, 10-3/4" deep stainless steel ice bin, stainless steel front & sides, galvanized steel back & bottom, 1/2" NPS male drain, 1-5/8" tubular stainless steel legs with 1" adjustable thermoplastic feet, NSF

- 1 ea 4" Backsplash in lieu of standard 6" splash
- 1 ea Model ICC30 Ice Chest Covers, 2-piece sliding assembly, 30"W, front & back, stainless steel (for TS, TSD, & TSS ice chests)
- 1 ea Model SR-D30A Speed Rail, double, 30" W, stainless steel construction, factory installed

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ITEM 220 - SPARE NO.

ITEM 221 - SODA GUN - BY OTHER

Soda Gun - By Others

ITEM 222 - SODA GUN FILLER SECTION (1 REQ'D)

Perlick Corporation Model TS4SGB Dimensions: 22(h) x 4(w) x 18.56(d)

TS Series Soda Gun Filler Section, 4"W x 18-9/16"D x 22"H, all stainless steel construction, universal design accepts either Wunder-Bar® & Schroeder America™ 8-14 product soda manifolds & drip cups (accepts only NON-FLOW CONTROL manifolds that don't exceed 3" in overall thickness), interior mounted manifold conceals soda lines, tool-less removal of top cover provides easy access, integrated drip cup mounting allows concealed routing of drip tube to waste drain, accessory speed rails can bypass or terminate on Soda Gun Filler, soda manifold, hose gun & drip cup NOT included, NSF

ITEM 223 - DRAINBOARD (1 REQ'D)



Perlick Corporation Model TS24DB Dimensions: 36.5(h) x 24(w) x 18.56(d)

TS Series Underbar Drainboard, 24"W x 18-9/16"D, pitched drainboard top, all stainless steel construction, backsplash, Perlick Quick Clamp tool less leg attachment, stainless steel legs with adjustable thermoplastic feet (replaces TS24)

- 1 ea 4" backsplash
- 1 ea Model 1040635-24 TS Series 24"W Perforated Drainboard Insert, 'Stadium' shaped perforations, stainless steel construction, factory installed
- 1 ea Model SR-D24A Speed Rail, double, 24" W, stainless steel construction, factory installed

ITEM 224-230 - SPARE NO.

ITEM 231 - STONE BAR COUNTERTOP - BY OTHER

Stone Bar Countertop - By Others

ITEM 232 - POS MACHINE - BY OTHER

POS Machine - By Others

ITEM 233 - BACK BAR CABINET, REFRIGERATED (1 REQ'D)



Perlick Corporation Model BBS84 Dimensions: 34.56(h) x 84(w) x 24.75(d)

Refrigerated Back Bar Cabinet, three-section, 84"W, self-contained refrigeration, 24.8 cu.ft. internal volume, digital thermostat, LED interior lighting, front vented, automatic defrost & condensate evaporator, includes floor drain, stainless steel interior, side mount compressor, 1/4 HP, R290 Hydrocarbon refrigerant, NSF, cULus

- 1 ea WARNING: The materials used in this product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
- 1 ea 120v/60/1-ph, 4.2 amps, NEMA 5-15P
- 1 ea 5 yr. compressor warranty, 1 yr. parts & labor warranty

1 ea	Black exterior finish
1 ea	Model 67437-14B Door type, first: glass with black door frame
1 ea	Door hinge location, first: Left
1 ea	Shelving style, first: (3) flat shelves
1 ea	Model 67437-14B Door type, second: glass with black door frame
1 ea	Door hinge location, second: Left
1 ea	Shelving style, second: (3) flat shelves
1 ea	Model 67437-14B Door type, third: glass with black door frame
1 ea	Door hinge location, third: Right
1 ea	Shelving style, third: (3) flat shelves
1 ea	Standard refrigerator
1 ea	no tapping holes
1 ea	Condensing unit location: Right
1 ea	Crisp White LED
1 st	Model 67062 Casters, 2-7/8", set of (6)

ITEM 234 - BACK BAR CABINET, REFRIGERATED (1 REQ'D)



Perlick Corporation Model BBS84 Dimensions: 34.56(h) x 84(w) x 24.75(d)

Refrigerated Back Bar Cabinet, three-section, 84"W, self-contained refrigeration, 24.8 cu.ft. internal volume, digital thermostat, LED interior lighting, front vented, automatic defrost & condensate evaporator, includes floor drain, stainless steel interior, side mount compressor, 1/4 HP, R290 Hydrocarbon refrigerant, NSF, cULus

1 ea	WARNING: The materials used in this product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
1 ea	120v/60/1-ph, 4.2 amps, NEMA 5-15P
1 ea	5 yr. compressor warranty, 1 yr. parts & labor warranty
1 ea	Black exterior finish
1 ea	Model 67437-14B Door type, first: glass with black door frame
1 ea	Door hinge location, first: Left
1 ea	Shelving style, first: (3) flat shelves
1 ea	Model 67437-14B Door type, second: glass with black door frame
1 ea	Door hinge location, second: Left
1 ea	Shelving style, second: (3) flat shelves
1 ea	Model 67437-14B Door type, third: glass with black door frame
1 ea	Door hinge location, third: Right
1 ea	Shelving style, third: (3) flat shelves
1 ea	Standard refrigerator
1 ea	no tapping holes
1 ea	Condensing unit location: Left
1 ea	Crisp White LED
1 st	Model 67062 Casters, 2-7/8", set of (6)

ITEM 235 - SPARE NO.

ITEM 236 - DRAINBOARD (1 REQ'D)



Perlick Corporation Model TS12DB Dimensions: 36.5(h) x 12(w) x 18.56(d)

TS Series Underbar Drainboard, 12"W x 18-9/16"D, pitched drainboard top, all stainless steel construction, backsplash, Perlick Quick Clamp tool less leg attachment, stainless steel legs with adjustable thermoplastic feet (replaces TS12)

1 ea 4" backsplash

1 ea Model 1040635-12 TS Series 12"W Perforated Drainboard Insert, 'Stadium' shaped perforations, stainless steel construction, factory installed

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ITEM 237 - STAINLESS DRINK RAIL (1 REQ'D)

Custom Model DRINK RAIL

Custom Stainless Shelf with Drink Rail, 6'-9", Per Plans

ITEM 238 - SPARE NO.

ITEM 239 - WASTE CABINET (1 REQ'D)



Perlick Corporation Model TS12DS Dimensions: 36.5(h) x 12(w) x 18.56(d)

TS Series Underbar Wet Waste Sink Unit, 12"W x 18-9/16"D, 10" wide x 14" front-to-back x 9-1/4" deep 18 gauge stainless steel sink, backsplash, 4" OC splash mount faucet holes, 1-1/2" NPS male drain, stainless steel construction, Perlick Quick Clamp tool less leg attachment, stainless steel legs with 1" adjustable thermoplastic feet (replaces TS12HS)

1 ea 4" Backsplash in lieu of standard 6" splash

1 ea Model 934GN-LF Front Loading Faucet, wall/splash mount, lead free, gooseneck spout, faucet valves includes: built-in check valves to prevent back flow or across flow, (2) 3/8" O.D. x 3/8" O.D. x 18", braided stainless steel supply lines included

1 ea Model 7055-48 Perforated Wet Waste Pan, 7 quart capacity, stainless steel (10-3/8" x 12-3/4" x 4" deep)

ITEM 240 - SPARE NO.

ITEM 241 - SODA GUN FILLER SECTION (1 REQ'D)

Perlick Corporation Model TS4SGB Dimensions: 22(h) x 4(w) x 18.56(d)

TS Series Soda Gun Filler Section, 4"W x 18-9/16"D x 22"H, all stainless steel construction, universal design accepts either Wunder-Bar® & Schroeder America™ 8-14 product soda manifolds & drip cups (accepts only NON-FLOW CONTROL manifolds that don't exceed 3" in overall thickness), interior mounted manifold conceals soda lines, tool-less removal of top cover provides easy access, integrated drip cup mounting allows concealed routing of drip tube to waste drain, accessory speed rails can bypass or terminate on Soda Gun Filler, soda manifold, hose gun & drip cup NOT included, NSF

ITEM 241A - SODA GUN - BY OTHER

Soda Gun - By Others

ITEM 242 - REFRIGERATED MERCHANDISER (1 REQ'D)



True Manufacturing Co., Inc. Model GDM-26-HC~TSL01 Dimensions: 78.63(h) x 30(w) x 29.88(d)

Refrigerated Merchandiser, one-section, True standard look version 01, (5) shelves, (1) Low-E thermal glass hinged door, LED interior lights, powder coated steel exterior, white interior with stainless steel floor, R290 Hydrocarbon refrigerant, 1/3 HP, 115v/60/1-ph, 5.4 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®

1 ea	7 year compressor warranty, 7 years parts warranty, 7 year labor warranty, standard. Visit www.truemfg.com for specifics.
1 ea	Self-contained refrigeration standard
1 ea	Exterior: Black powder coated steel, standard
1 ea	Interior: White aluminum, with white shelving, standard
1 ea	Left door hinging
1 ea	Sign, Plain White in lieu of standard
5 ea	TrueFlex bottle organizer
1 st	Castors, 2-1/2"

ITEM 243 - GARBAGE - BY OTHERS

Garbage - By Others

ITEM 244 - HAND SINK (1 REQ'D)



Perlick Corporation Model TSF12HS Dimensions: 36.5(h) x 12(w) x 22.25(d)

TSF Series Underbar Hand Sink Unit, 12"W x 24"D, 10" wide x 14" front-to-back x 9-1/4" deep 18 gauge stainless steel sink, backsplash, 4" OC splash mount faucet holes, (16) oz. pump soap dispenser integrated into front apron, C-fold paper towel dispenser integrated into front apron, stainless steel hinged door with magnetic catches, 1-1/2" NPS male drain, stainless steel construction, Perlick Quick Clamp tool less leg attachment, stainless steel legs with 1" adjustable thermoplastic feet (replaces TS12HSN)

1 ea	4" Backsplash in lieu of standard 6" splash
2 ea	Model 1039805 Perlick Flex Mount Leg Relocation Kit, Includes: (1) Rails, (1) Bolts, and (1)Tightening Knobs
1 ea	Model 934GN-LF Front Loading Faucet, wall/splash mount, lead free, gooseneck spout, faucet valves includes: built-in check valves to prevent back flow or across flow, (2) 3/8" O.D. x 3/8" O.D. x 18", braided stainless steel supply lines included
1 ea	Model 7054R End Splash, right, 6", for TS or TSF series
1 ea	Model 7054L End Splash, left, 6", for TS or TSF series

ITEM 245 - SPARE NO.

ITEM 246 - ICE BIN (1 REQ'D)



Perlick Corporation Model TS24IC10 Dimensions: 36.5(h) x 24(w) x 18.56(d)

TS Series Underbar Ice Bin/Cocktail Unit, modular with cold plate, 24"W x 18-9/16"D, approximately 50-lb. ice capacity, 10-circuit aluminum cold plate concealed under bin liner, 6"H backsplash with 1" return at top, ABS plastic top ledge, 10-3/4" deep stainless steel ice bin, stainless steel front & sides, galvanized steel back & bottom, 1/2" NPS male drain, 1-5/8" tubular stainless steel legs with 1" adjustable thermoplastic feet, NSF

1 ea 4" Backsplash in lieu of standard 6" splash

1 ea Model ICC24 Ice Chest Covers, 2-piece sliding assembly, 24"W, front & back, stainless steel (for TS, TSD, & TSS ice chests)

Please note that sales and use tax rates are subject to change by the taxing jurisdictions in which we collect tax. When this occurs we are required by law to collect from our customers at the new rates per the rules provided by the taxing jurisdiction.

Above pricing is good for 30 days from quotation date. Please call for extensions.

30% down payment at time of order.
60% due before delivery of equipment
10% due upon job completion

All gas, plumbing and electric, including all control wiring and inter-connection of any individual items, is by others.

Ventilation does not include roof penetrations, duct work or fire rating duct work, light bulbs, sprinkling of duct work, roof curbs, permits, or interlock between exhaust fan and make-up air units. All roof top equipment to be by others. Receiving and installation of hoods by others. Hood pricing is based on ceiling grid being installed and fastened to top of hood and does not include any insulation on ventilator if exposed into ceiling or required by fire codes.

Fire extinguishing system does not include final connection of surface and duct collar nozzles. Piping to test valve and drain to be done by Sprinkler Contractor. Gas solenoid valve provided by Premier and installed by others. Shunt trip circuit breakers to be provided and installed by others.

Walk-in boxes do not include any enclosures to ceiling unless otherwise specified and noted. Light bulbs and fluorescent light bulbs are not included and are to be by others.

Dunnage removal by others. The dunnage will be stacked, piled and loaded into a dumpster provided by others on jobsite at time of installation. If provisions to remove dunnage from jobsite are not made, additional cost incurred by Premier to do so will be added to our invoice.

Permit, plan review fee, health department and inspection fees by others.

Prices and specifications subject to changes after review of local inspectors and health department.

Orders will not be executed until all credit terms and contract documents have been completed and approved.

Installation price does not include any crane or special unloading equipment charges or overtime rates. Our installation quote is based on the site being ready to accept equipment. The site is ready for equipment installation and fixtures when:
1. Access is clear to enter the building and kitchen for setting equipment from a finished parking lot surface suitable for fork truck.
2. The finished floor must be complete, grouted, and clean of construction materials and debris.
3. Walls have finish material applied.
4. Ceiling grid and pads are installed. If not installed, owner will take responsibility for any equipment damage caused by other trades people.
5. Plumber and electrician are on the job site.
Any additional trips to the site, movement or storage of equipment resulting from site being inaccessible or not ready, will be charged as an extra to the contract.

Final set and sealing will only be done once. If a second trip is required due to lack of other trade or customer cooperation, the additional labor will be added as an extra to the contract at prevailing rates. Any overtime costs incurred for reasons beyond our control required to complete this installation within the time frame outlined will be charged as an extra to the contract.

All equipment is to be started up at the same time. If additional trips are required due to lack of other trade or customer cooperation, the additional labor will be added as an extra to the contract at prevailing rates.

Manufacturer's standard catalog items are returnable subject to manufacturer's acceptance. Items must be unused and packaged in original carton. Manufacturer's standard restocking charge plus return freight to factory will be deducted from the credit issued by Premier. If not in original carton, a cartoning or crating charge will apply. Custom equipment is not returnable.

The research and compliance with governmental and insurance code requirements not specifically addressed in this proposal, is and remains the responsibility of others.

Premier extends the same warranties on the equipment quoted as are extended to Premier by the Manufacturer. All warranty information is available at the principal offices of Premier.

Sales Tax as listed above is based on current tax rates and codes. If there are changes to the tax rate and/or tax code, sales tax on the final invoice will be based on the prevailing rate at the time the project is completed, regardless of when the contract was signed. Premier is not liable for legislative changes that affect sales tax.

Thank you for the opportunity to quote on the above items. If you have any questions please feel free to call. We look forward to the opportunity to work with you on this project.

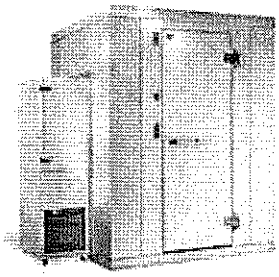
Sincerely,

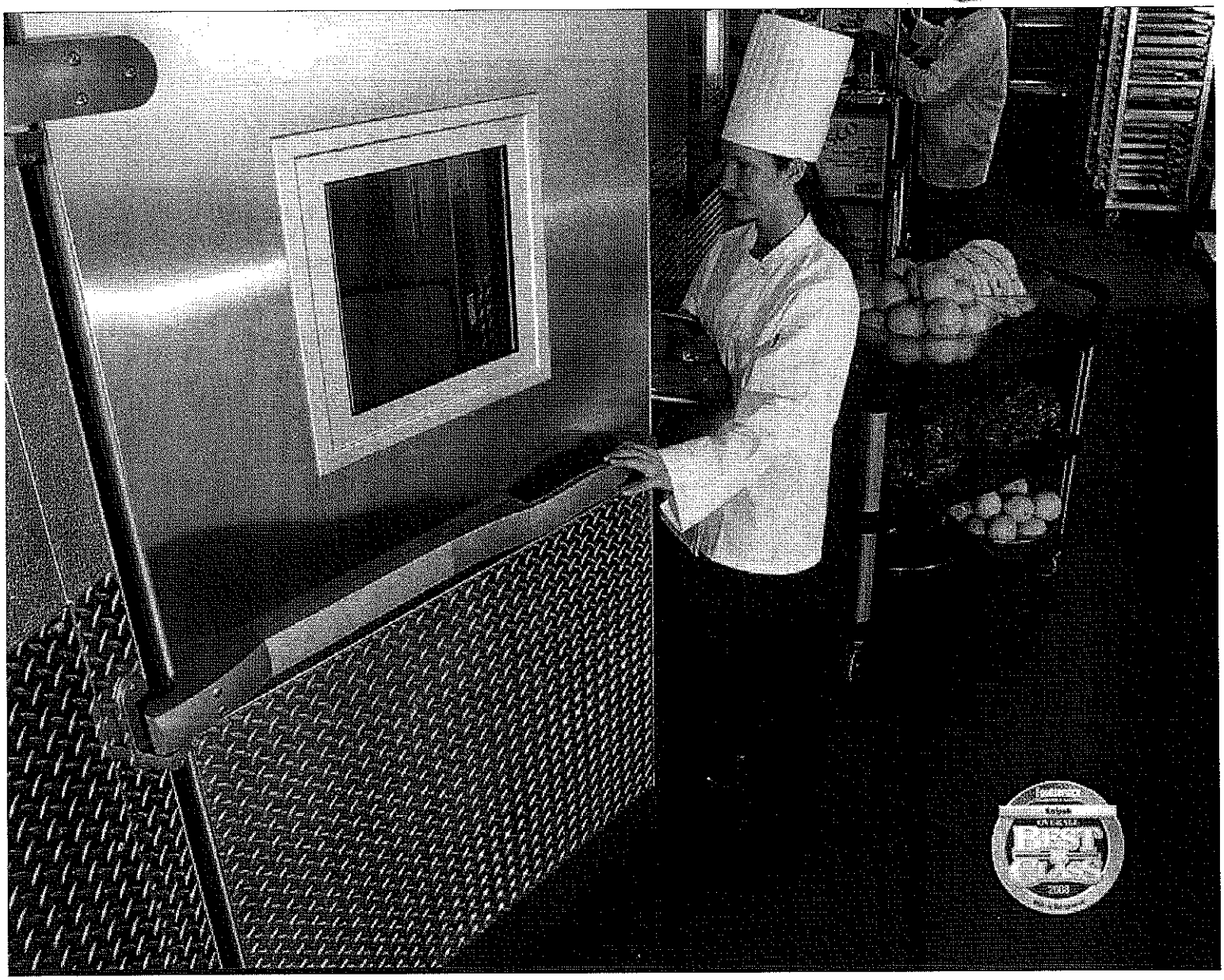
Todd Olson C.F.S.P.
Premier Restaurant Equipment Co.

Above pricing does not include construction, plumbing, electrical, HVAC, Hanging of hoods, ductwork, fans, make up air, hood controls, hood sensors, and is subject to health dept. approval. Note: Non Union Installation Pricing quoted **NOTE: SOME LOCATIONS DO NOT ALLOW FOR THE USE OF HEAT SENSORS IN THE EXHAUST DUCT. THEY REQUIRE A “DRAFT INTERLOCK” TO BE PLACED IN THE KITCHENS WITH SENSORS TO BRING ON THE FANS. WE DO NOT INCLUDE THE “DRAFT INTERLOCK” DEVICES IN OUR PROPOSAL. THIS IS MOST COMMONLY SUPPLIED AND INSTALLED BY THE PLUMBING OR HVAC CONTRACTOR. THEY ARE NOT INCLUDED IN THIS PROPOSAL.**

Kolpak

Three ways to get Kolpak quality in your kitchen

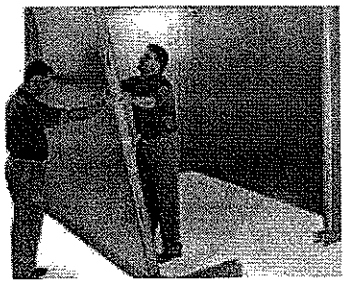




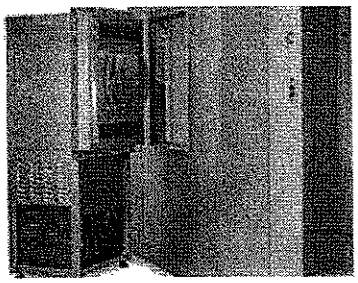
Manitowoc

Kolpak Polar-Pak

Walk-in to convenience



Polar-Pak®can easily be installed in practically no time at all without the services of a refrigeration technician or plumber.



Available in both top-mount and side-mount models.

Unsurpassed quality - Host of standard features

Polar-Pak coolers and freezers are made with the same rugged, high performance construction that has made Kolpak the leader in walk-in refrigeration. The Polar-Pak modular panels of 4" 100% foamed in place non-CFC urethane foam offer superior insulating capabilities. The exterior and interior of top-quality galvanized metal offer an attractive and rugged finish. Polar-Pak also offers superior air circulation around the coils making it both economical and efficient to run.

- Top-mount refrigeration is flush to the interior
- Hot gas condensate evaporator
- Superior door construction to seal in cold, prevent condensation
- Posi-Loc panel fasteners for a perfect airtight fit
- Adjustable hinges and durable handle
- Interior safety release to prevent accidental entrapment
- Coved corners on floor panels for easier cleaning, greater sanitation
- Heated air-vents on freezers to eliminate vacuum and pressure build-up

No other manufacturer offers you greater flexibility

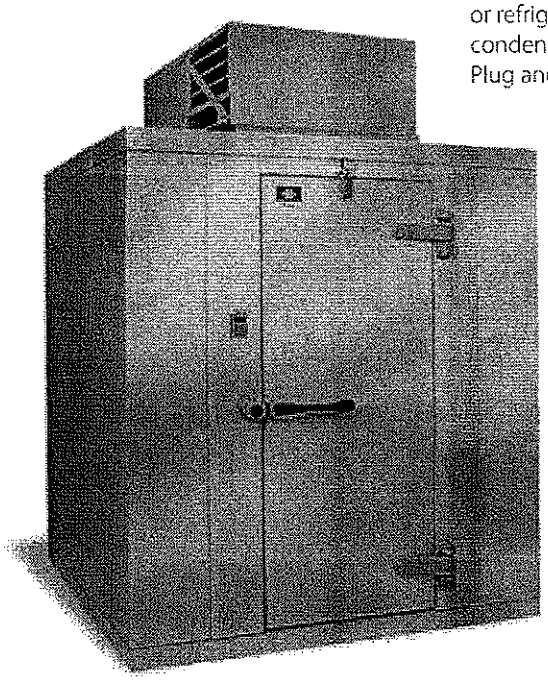
Polar-Pak is flexible enough to be used in virtually any configuration. There is no need for numbered panels. Some standard 7'6" high units are part of our Polar-Pak program, and will ship within 7 working days after your order has been received. Orders specifying options will require standard lead times.

100% usable storage space

Flush fit ceiling coil design allows full use of walk-in interior for storage.

Quick and cost-saving installation

The top-mount self-contained refrigeration package significantly reduces refrigeration labor costs. Installation is quick and easy and can be completed without the services of a plumber or refrigeration technician. Plumbing is not required. The standard automatic condensate evaporator eliminates the need for a drain line on indoor units. Plug and play design.



Design flexibility

Available in cooler, freezer, or combination cooler/freezer. You can choose from top or side-mount refrigeration. Floor or floorless application, indoor or outdoor, two ceiling heights (6'6" or 7'6") and standard panels allow for various layouts.

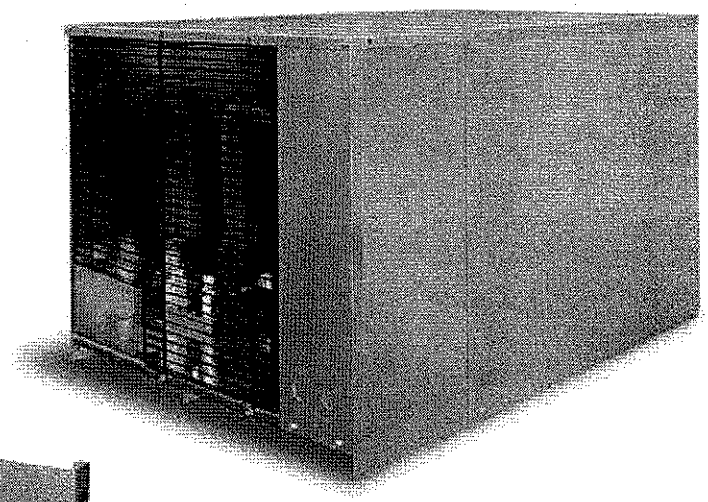
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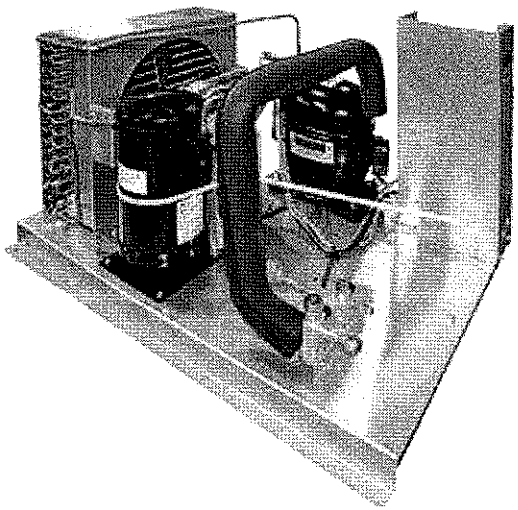
Kolpak

120 Series Refrigeration Systems

Air Cooled Indoor/Outdoor Condensing Units

Hermetic / Scroll / Semi-Hermetic
½ thru 6 Hp Models

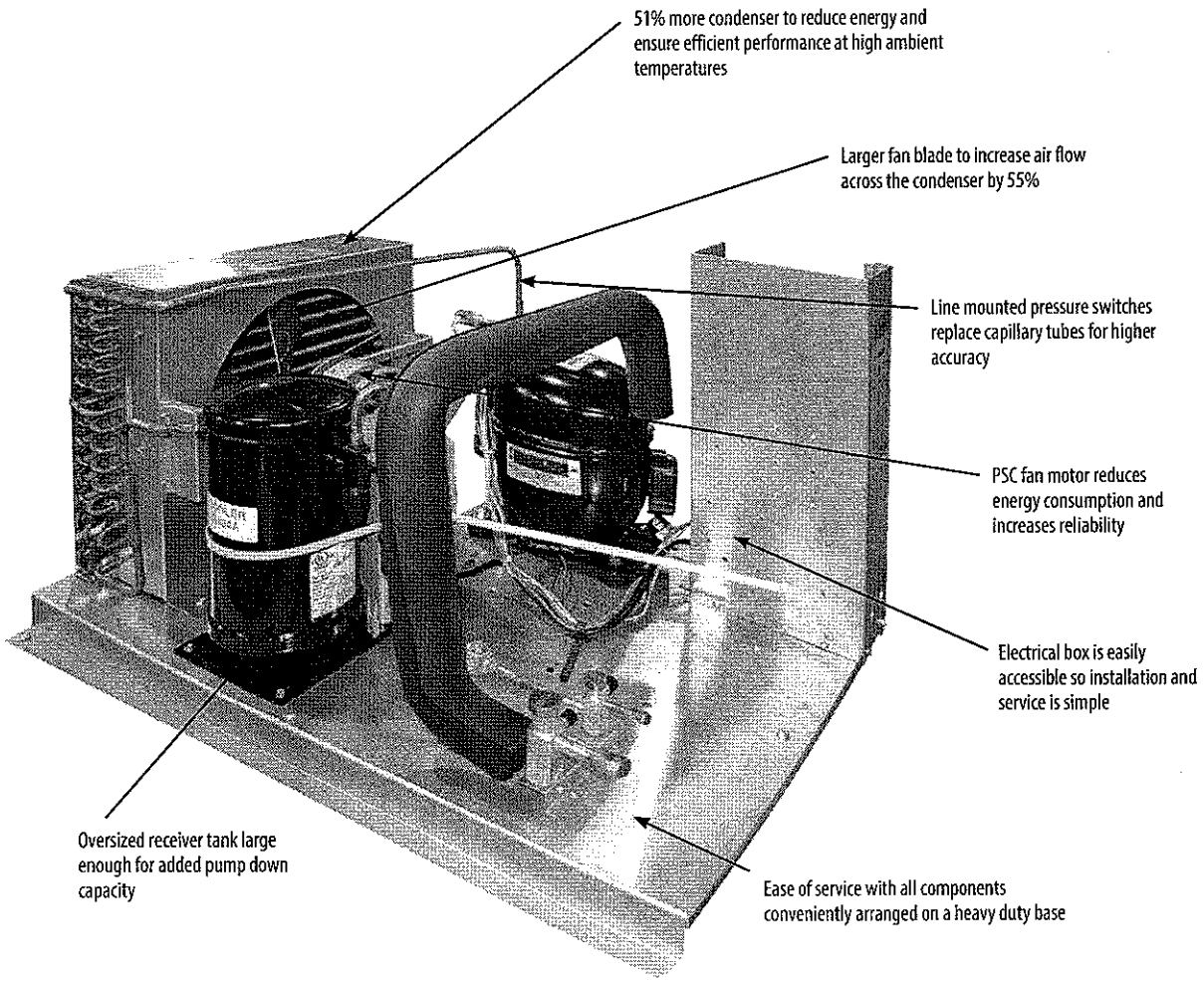




Manitowoc

Kolpak 120

The 120 High Side System is a high efficiency air-cooled refrigeration condensing unit designed specifically to operate on Walk-ins over a wide range of ambient temperatures.



Features and benefits of the 120 System:

Operates effectively from -20°F to +120°F without exceeding the design and safety criteria of components.

Ease of service with all components conveniently arranged on a heavy duty base to be accessible for adjustments and repairs when necessary.

Provides an efficient balance between compressor, condenser surface, air movement and controls. The units are equipped with extra condensing surface, oversized fan blades and PSC fan motors. The oversized fan blade powered by the PSC motor moves air more efficiently to use less electricity.

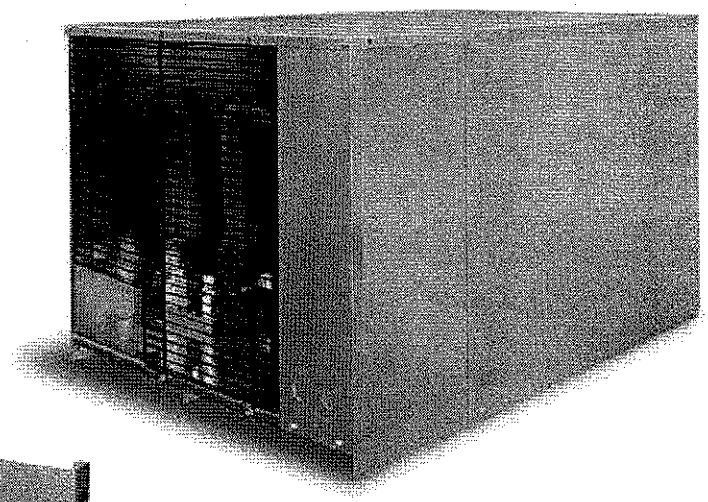
High accuracy pressure switches are used in place of capillary tubes to eliminate possible leakage points.

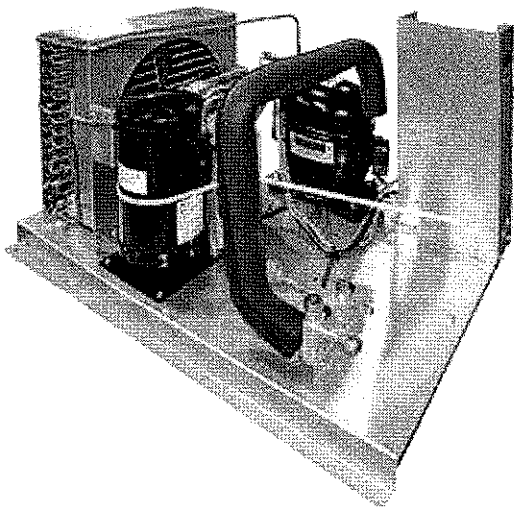
Kolpak

120 Series Refrigeration Systems

Air Cooled Indoor/Outdoor Condensing Units

Hermetic / Scroll / Semi-Hermetic
½ thru 6 Hp Models

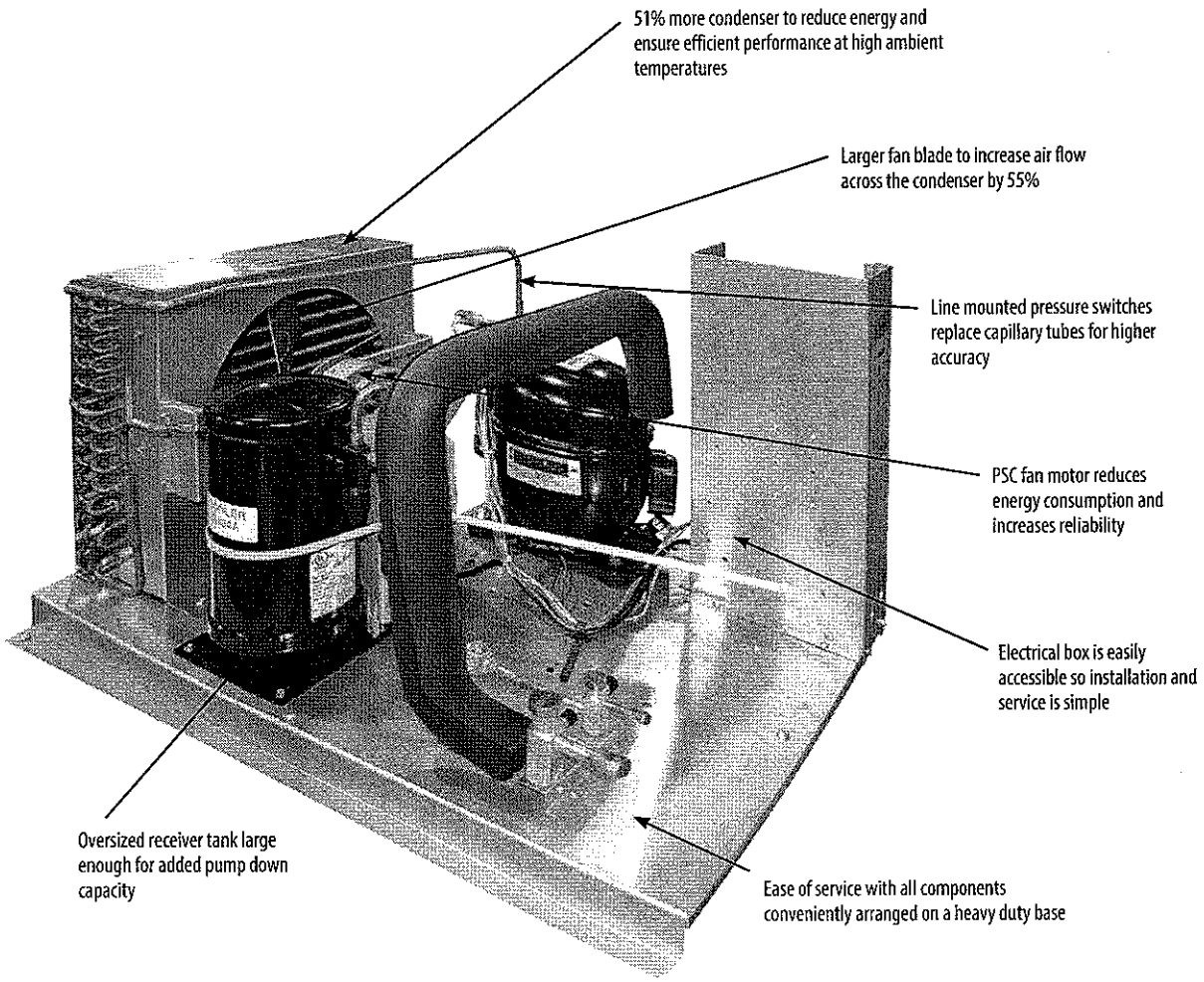




Manitowoc

Kolpak 120

The 120 High Side System is a high efficiency air-cooled refrigeration condensing unit designed specifically to operate on Walk-ins over a wide range of ambient temperatures.



Features and benefits of the 120 System:

Operates effectively from -20°F to +120°F without exceeding the design and safety criteria of components.

Ease of service with all components conveniently arranged on a heavy duty base to be accessible for adjustments and repairs when necessary.

Provides an efficient balance between compressor, condenser surface, air movement and controls. The units are equipped with extra condensing surface, oversized fan blades and PSC fan motors. The oversized fan blade powered by the PSC motor moves air more efficiently to use less electricity.

High accuracy pressure switches are used in place of capillary tubes to eliminate possible leakage points.

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

081820

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"ABPR" ALUMINUM MOBILE PAN RACKS - FRONT LOAD

FEATURES:

- 6063 ALUMINUM 1" SQUARE TUBING
- BOLTED CROSS RAILS
- 3" SPACING - 20 PAN CAPACITY
- 26" X 20-1/2" X 69"
- 5" CASTERS

CONSTRUCTION:

- RACK: 6063 ALUMINUM; MIG WELDED.

MATERIAL:

- 6063 ALUMINUM



NESTING RACKS



ABPR-1820-3KD



ABPR-1820-RKD



ABPR-1820-ZN

STANDARD MOBILE PAN RACK- SQUARE TOP DESIGN

MODEL #	QTY
ABPR-1820-3KD	

NESTED MOBILE PAN RACK- SQUARE TOP DESIGN

MODEL #	QTY
ABPR-1820-ZN	

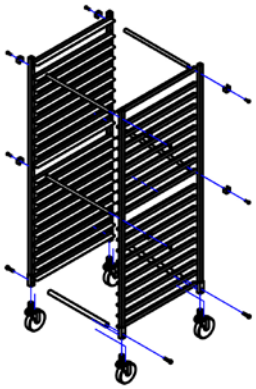
STANDARD MOBILE PAN RACK- ROUND TOP DESIGN

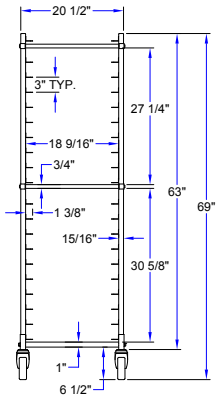
MODEL #	QTY
ABPR-1820-RKD	

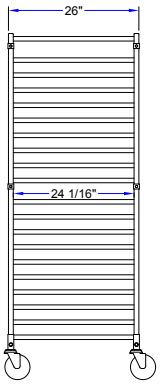
CLEAR PLASTIC COVER (FRONT LOAD PAN RACKS ONLY)

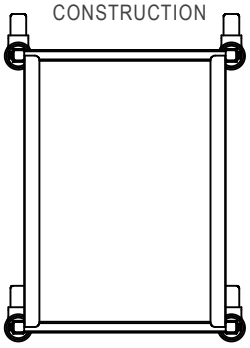
MODEL #	QTY
ABPR-1820-PC	

DETAILED SPECIFICATIONS



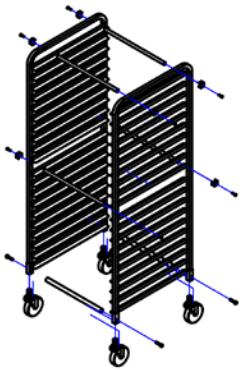


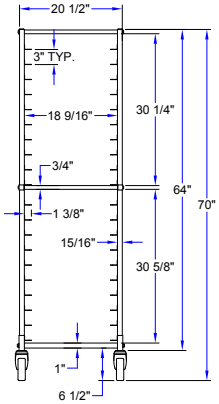


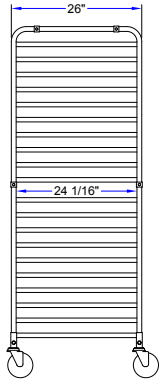


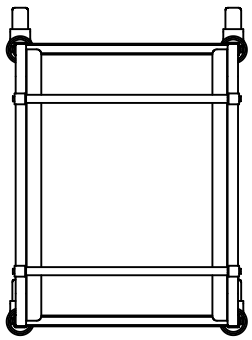
STANDARD MOBILE PAN RACK- SQUARE TOP DESIGN

MODEL #	LENGTH	WIDTH	HEIGHT	WT. (LBS)	WT. LIMIT/RACK (LBS)	WT. LIMIT/PAN (LBS)
ABPR-1820-3KD	26"	20-1/2"	69"	30	200	10





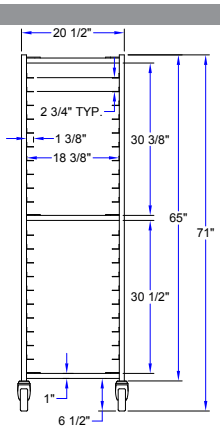


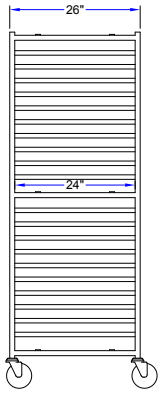


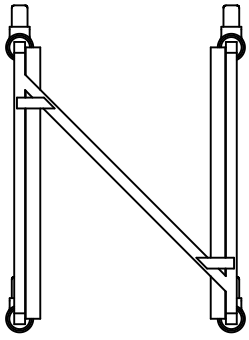
STANDARD MOBILE PAN RACK- ROUND TOP DESIGN

MODEL #	LENGTH	WIDTH	HEIGHT	WT. (LBS)	WT. LIMIT/RACK(LBS)	WT. LIMIT/PAN (LBS)
ABPR-1820-RKD	26"	20-1/2"	70"	30	200	10









NESTED MOBILE PAN RACK- SQUARE TOP DESIGN

MODEL #	LENGTH	WIDTH	HEIGHT	WT. (LBS)	WT. LIMIT/RACK(LBS)	WT. LIMIT/PAN (LBS)
ABPR-1820-ZN	26"	20-1/2"	71"	30	300	15

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

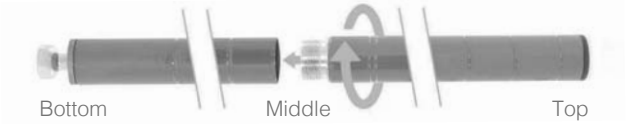
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

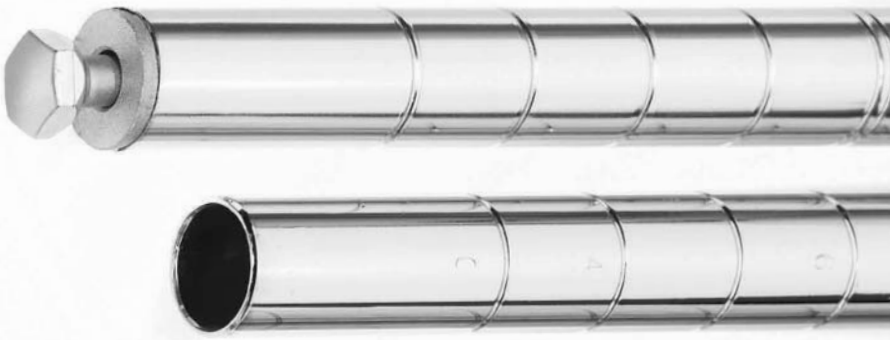
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

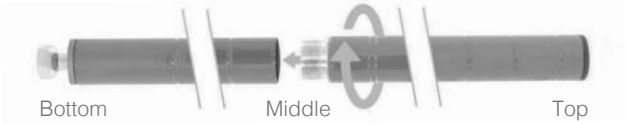
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

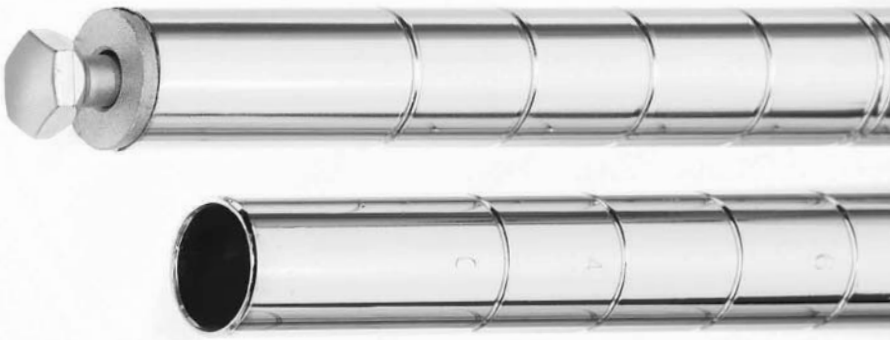
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7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

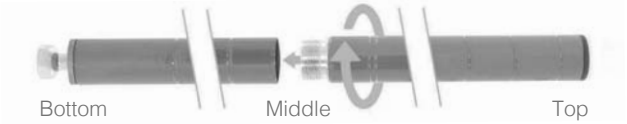
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
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74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

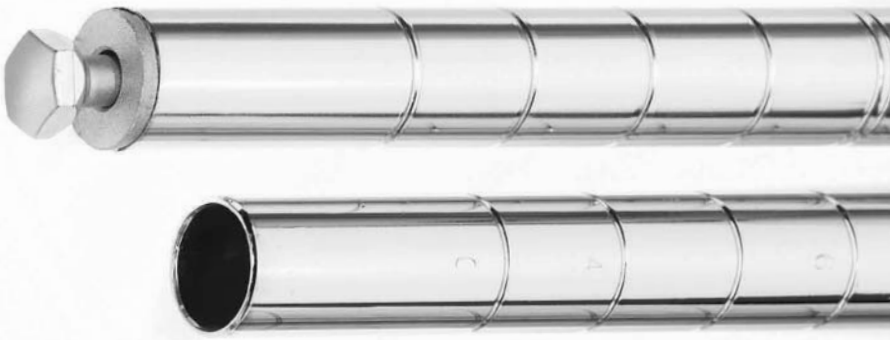
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7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

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Stationary Post with adjustable leveling foot
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See Casters on Next Page ▸

SHELVES

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14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
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18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

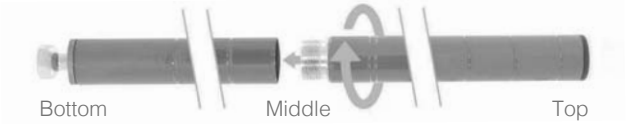
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

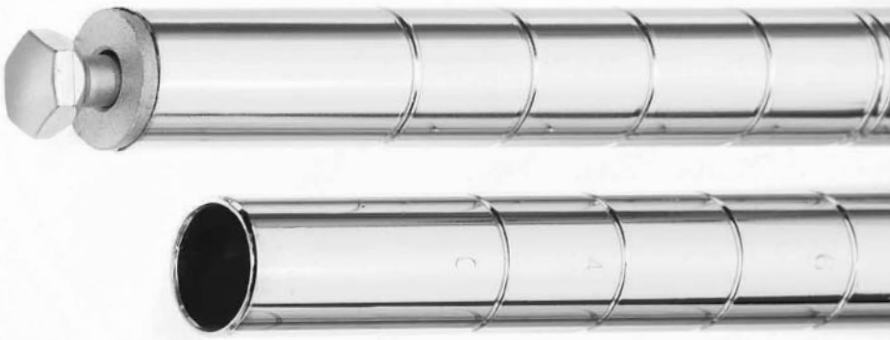
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

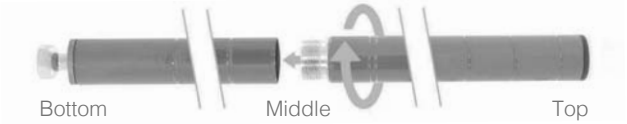
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

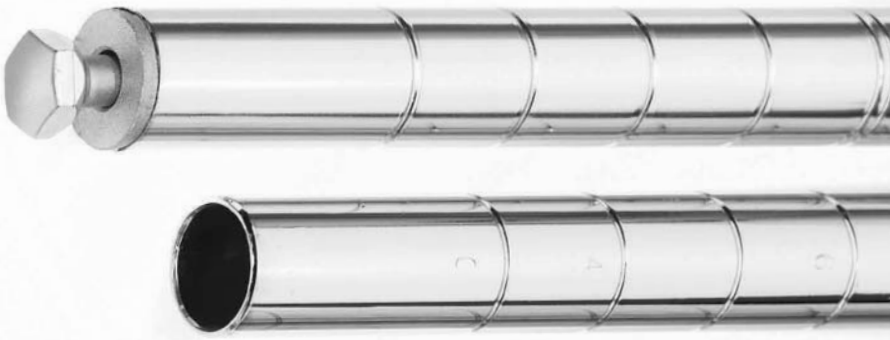
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



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See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

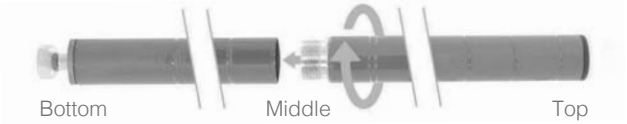
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

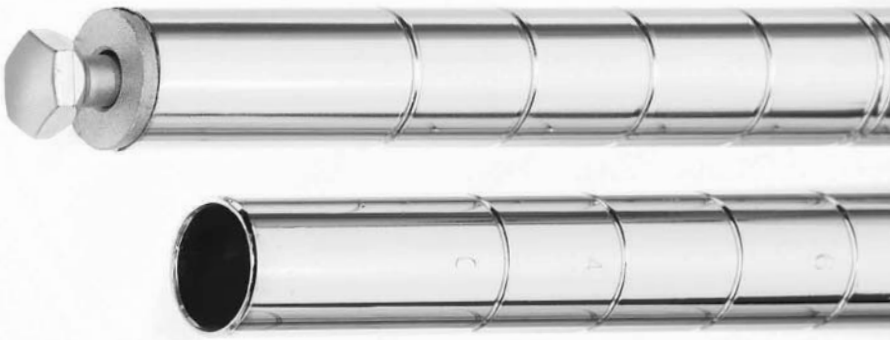
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
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See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

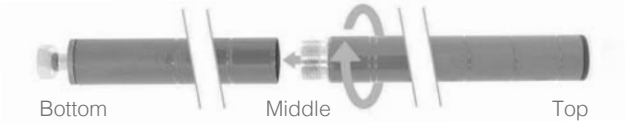
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

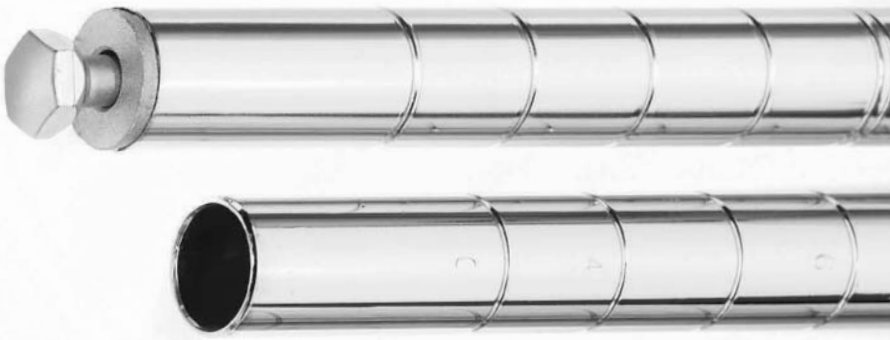
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

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Stationary Post with adjustable leveling foot
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See Casters on Next Page ▸

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

063017

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"EWS8" WALL SHELVES - STAINLESS STEEL 18GA

W/ 1.5" REAR RISER

FEATURES:

- TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- FINISHED W/ A SAFETY STALLION FRONT EDGE
- 1-1/2" TURNED UP BACKSPLASH
- 12" OR 16" DEPTH
- SHIPPED KNOCKED-DOWN, EASY-TO-ASSEMBLE (MOST SHIP UPS)
- ALL MODELS ARE NSF CERTIFIED



EWS8-1236

CONSTRUCTION:

- STAINLESS STEEL SHELVES ARE TIG WELDED
- EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE

MATERIAL:

- SHELF: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- BRACKETS: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH



EWS8-1636

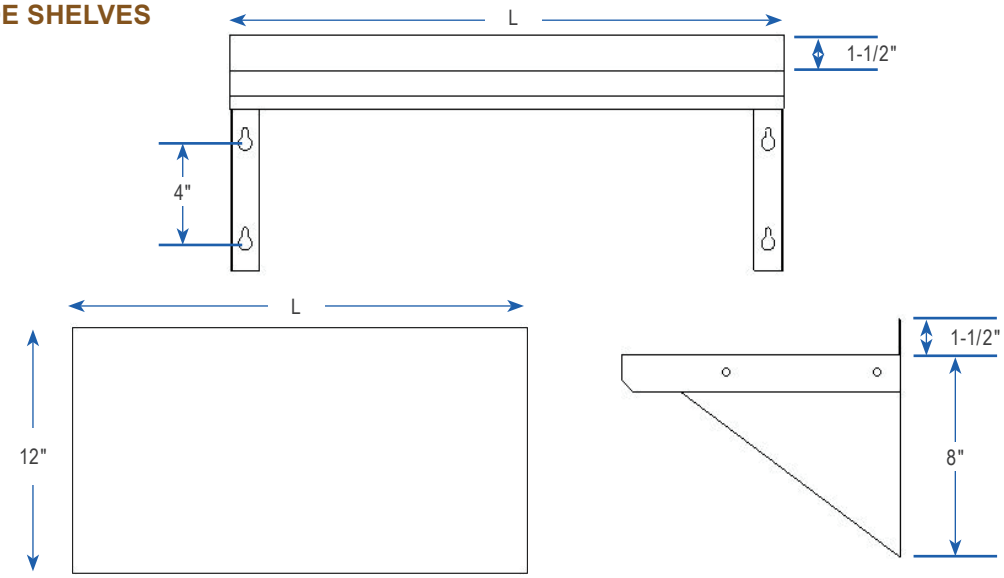
18GA STAINLESS STEEL F

12" WIDE	QTY	16" WIDE	QTY
EWS8-1224		EWS8-1624	
EWS8-1236		EWS8-1636	
EWS8-1248		EWS8-1648	
EWS8-1260		EWS8-1660	
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EWS8-1296		EWS8-1696	

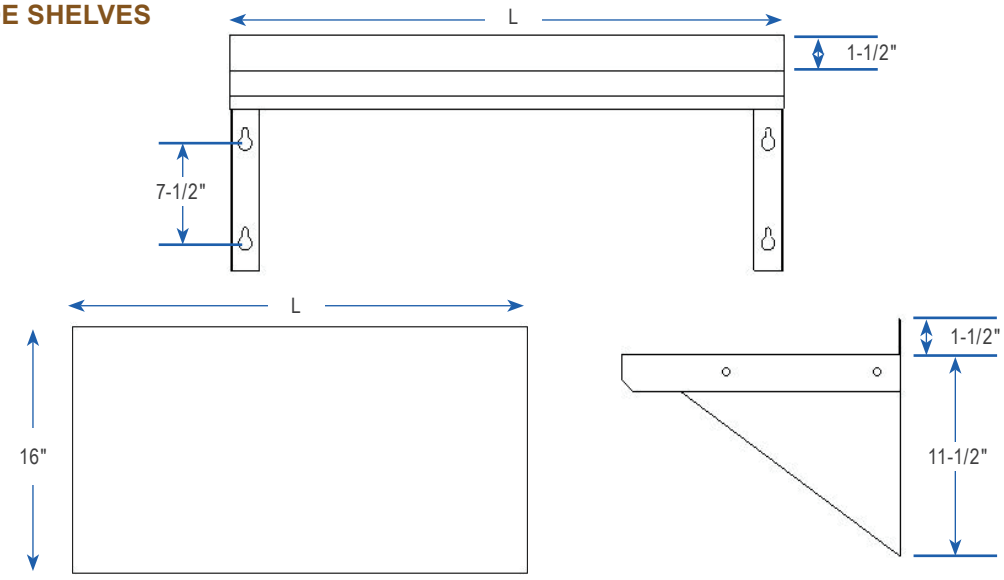
UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS.

DETAILED SPECIFICATIONS

12" WIDE SHELVES



16" WIDE SHELVES



18GA STAINLESS STEEL WALL SHELF

LENGTH	12" WIDE	WT. (LBS)	16" WIDE	WT. (LBS)
24"	EWS8-1224	8	EWS8-1624	10
36"	EWS8-1236	12	EWS8-1636	14
48"	EWS8-1248	16	EWS8-1648	18
60"	EWS8-1260	21	EWS8-1660	24
72"	EWS8-1272	25	EWS8-1672	30
84"	EWS8-1284	29	EWS8-1684	35
96"	EWS8-1296	33	EWS8-1696	38

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

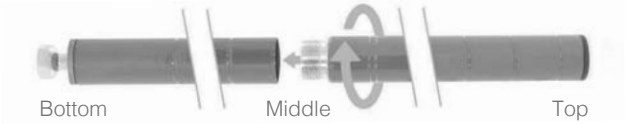
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

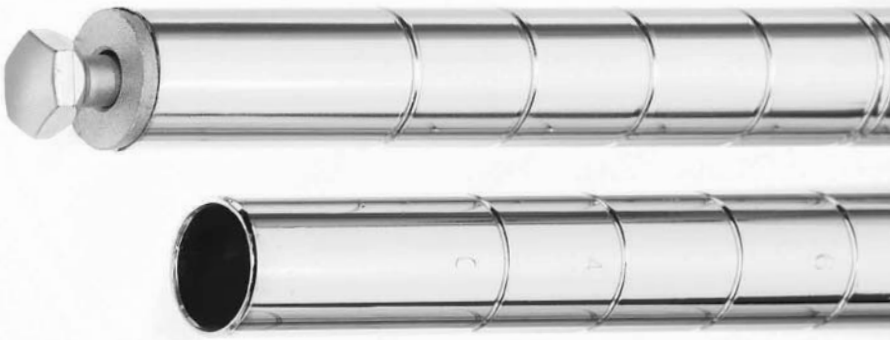
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

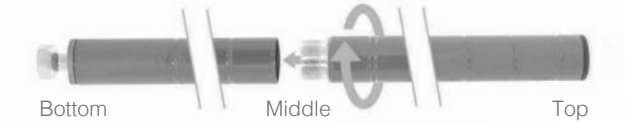
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

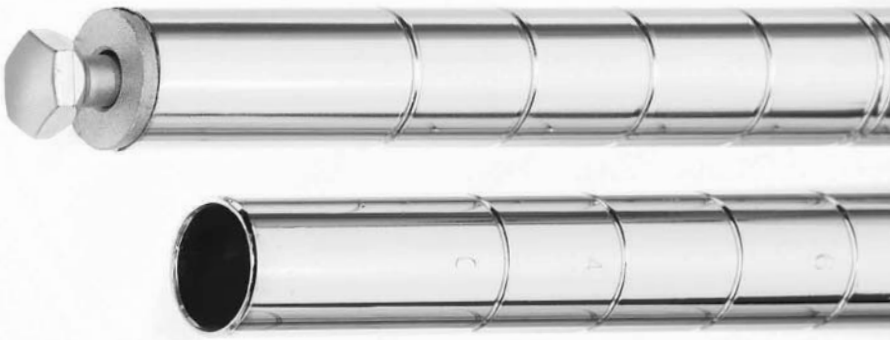
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

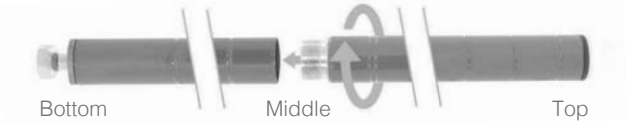
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

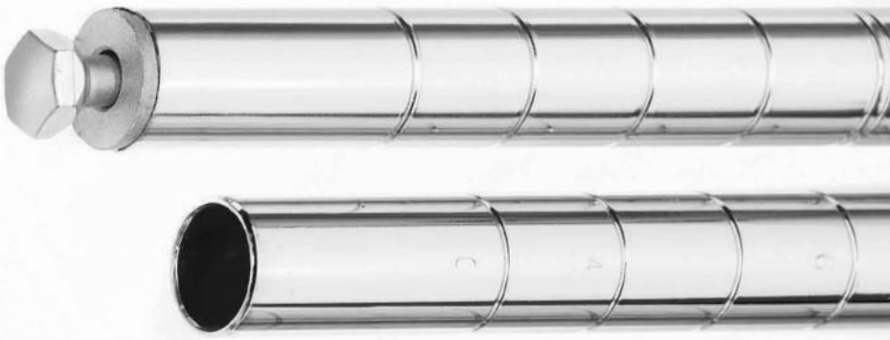
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



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See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

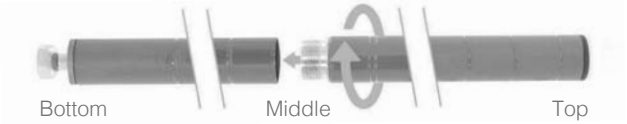
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

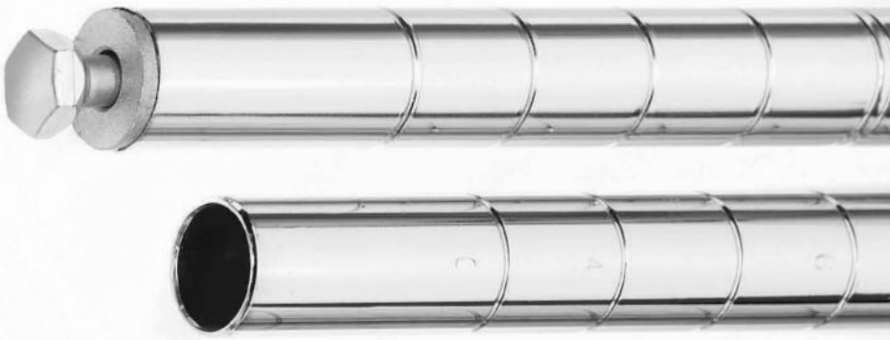
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

090618

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"3B-2D" "B-SERIES" SINKS

FEATURES:

- 16GA STAINLESS STEEL
- TYPE 300 STAINLESS STEEL WITH #4 POLISH, SATIN FINISH
- 14" DEEP BOWLS
- ALL CORNERS, BOTH VERTICAL AND HORIZONTAL, COVED AT 3/4" RADIUS
- BOTTOMS OF BOWLS FORMED FOR DRAINAGE TO 3-1/2" DIAMETER DIE STAMPED OPENING
- FULL LENGTH **10" HIGH BOXED BACKSPLASH,** WITH 2" RETURN TO WALL AT 45 DEGREE AND 1" TURNED DOWN REAR LIP
- 1" FAUCET HOLES IN BACKSPLASH
- ALL OUTSIDE CORNERS OF ASSEMBLY ARE BULLNOSED TO PROVIDE SAFE, CLEAN, AND POLISHED EDGE
- STANDARD STAINLESS STEEL LEGS 1-5/8" DIAMETER

CONSTRUCTION:

- TOP: STAINLESS STEEL SINKS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE
- BASE: STAINLESS STEEL BASES ARE MIG WELDED

MATERIAL:

- BOWLS & TOP: 16GA TYPE 300 STAINLESS STEEL WITH #4 POLISH, SATIN FINISH
- LEGS: 1-5/8" ROUND O.D. STAINLESS STEEL
- BRACING: 1-1/4" ROUND O.D. STAINLESS STEEL
- GUSSETS: STAINLESS STEEL
- FEET: 1" ADJUSTABLE STAINLESS STEEL BULLET FEET



3B18244-2D18
(Model showing one set of faucet holes.)

STANDARD 16GA "3B-2D" "B-SERIES" SINK

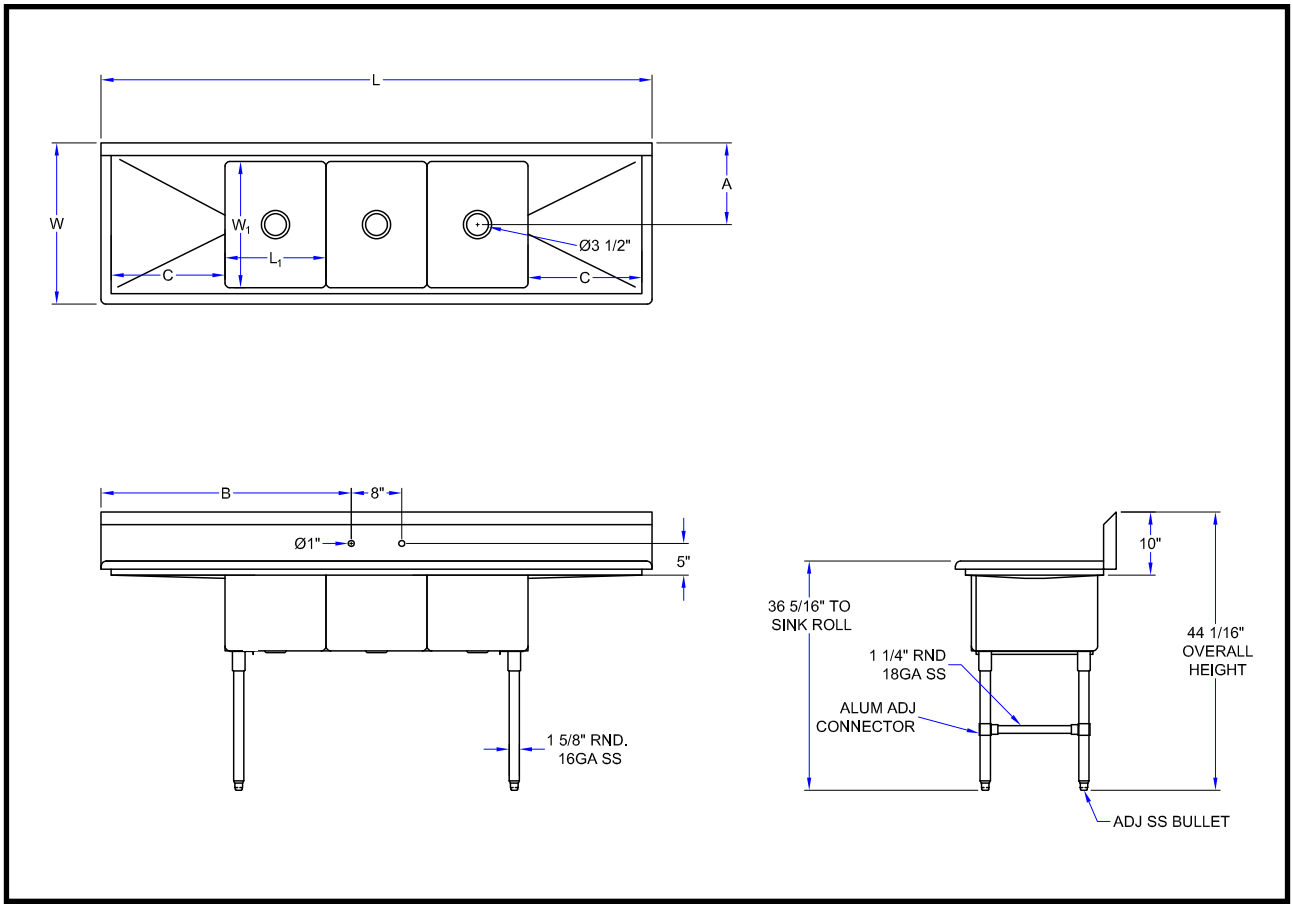
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3B16204-2D24	
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3B18244-2D18	
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3B20304-2D20	
3B20304-2D24	
3B20304-2D30	
3B244-2D24 *	

* WITH TWO SETS OF FAUCET HOLES

OPTIONAL ACCESSORIES

DESCRIPTION	QTY
FAUCETS	
ADD-A-FAUCETS	
PRE-RINSE UNITS	
LEVEL WASTE	
OVERSHELVES	
POT RACK	

DETAILED SPECIFICATIONS



16GA - "3B-2D" "B SERIES" SINK

14" DEEP	L	W	L1	W1	A	B	C
3B16204-2D18	87-1/4"	25-1/2"	16"	20"	12-15/16"	39-5/8"	18"
3B16204-2D24	99-1/4"	25-1/2"	16"	20"	12-15/16"	45-5/8"	24"
3B16204-2D36	123-1/4"	25-1/2"	16"	20"	12-15/16"	57-5/8"	36"
3B184-2D18	93-1/4"	23-1/2"	18"	18"	11-15/16"	42-5/8"	18"
3B18244-2D18	93-1/4"	29-1/2"	18"	24"	14-15/16"	42-5/8"	18"
3B18244-2D24	105-1/4"	29-1/2"	18"	24"	14-15/16"	48-5/8"	24"
3B20304-2D20	103"	35-1/2"	20"	30"	18-3/16"	47-5/8"	20"
3B20304-2D24	111"	35-1/2"	20"	30"	18-3/16"	51-5/8"	24"
3B20304-2D30	123"	35-1/2"	20"	30"	18-3/16"	57-5/8"	30"
3B244-2D24 *	123-1/4"	29-1/2"	24"	24"	14-15/16"	45-5/8"	24"

* WITH TWO SETS OF FAUCET HOLES

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

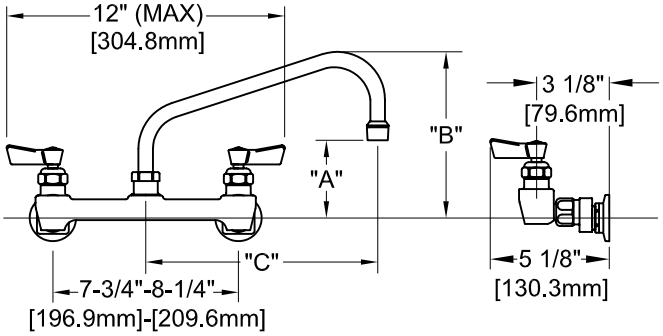
PRODUCT NAME:
8" ADJUSTABLE WALL MOUNT FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

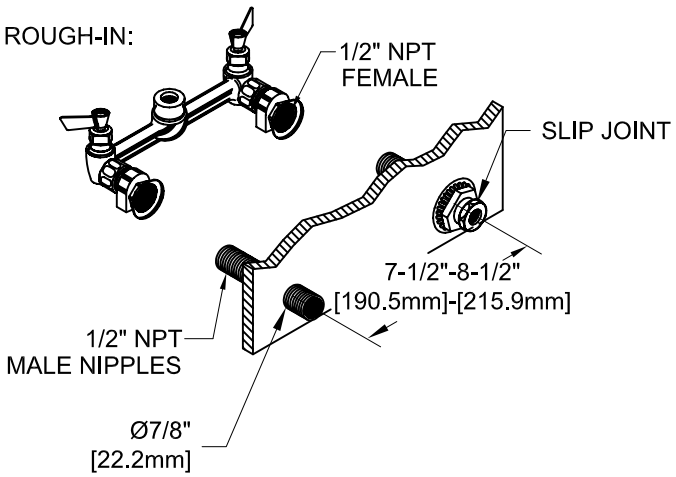
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:
- ☐ 3250 W/ 6" SWING SPOUT
- ☐ 3251 W/ 8" SWING SPOUT
- ☐ 3252 W/ 10" SWING SPOUT
- ☐ 3253 W/ 12" SWING SPOUT
- ☐ 3254 W/ 14" SWING SPOUT
- ☐ 9102 W/ 16" SWING SPOUT



MODEL	DIM "A"	DIM "B"	DIM "C"
3250	2-1/4" [57.2mm]	5-7/8" [149.2mm]	6" [152.4mm]
3251	2-1/2" [63.5mm]	6-3/8" [161.9mm]	8" [203.2mm]
3252	3-1/8" [79.4mm]	6-7/8" [174.6mm]	10" [254.0mm]
3253	3-3/4" [95.3mm]	7-3/8" [187.3mm]	12" [304.8mm]
3254	4-3/8" [111.1mm]	8-1/4" [209.6mm]	14" [355.6mm]
9102	5" [127.0mm]	8-7/8" [225.4mm]	16" [406.4mm]

ROUGH-IN:



ANSI/A112.18.1M

OPTIONS OR MODIFICATIONS:
- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ DJ SUB-ASSY (7-1/4" OR 13") CIRCLE LENGTH
- ☐ NIPPLES
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____

FEATURES:

* 8" ADJUSTABLE WALL MOUNT
* ECCENTRICS ADJUST FROM 7-3/4" TO 8-1/4"
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 5.0 LBS

FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3250 REV. B

JOB NAME:

QUANTITY:

ITEM NO.:

SPEC. S24090

E.C.O. # 3887

DATE: 05/15/01

PRODUCT NAME:

TWIST WASTE VALVE

☐ _____ SPECIAL CONFIGURATION
(CHECK BASE MODEL AND OPTIONS)

MODEL:

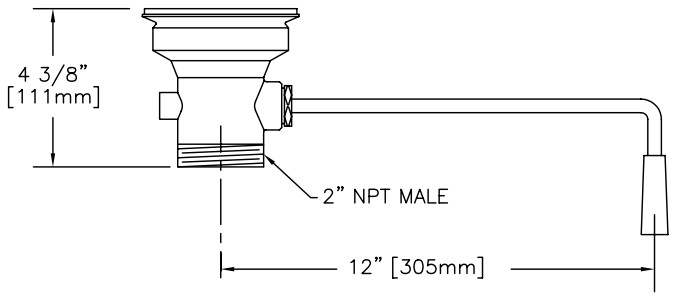
☐ 24090 WITH FLAT STRAINER

OPTIONS OR MODIFICATIONS:

☐ OTHER _____

FEATURES:

* 3 1/2" SINK OPENING
* 2" DRAIN OPENING
* CAST BRONZE BODY AND WORKING PARTS
* CHROME PLATED BODY AND WORKING PARTS
* FLAT STRAINER
* CSA CERTIFIED



DRAIN RATE:

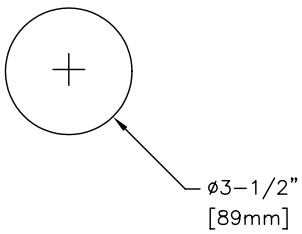
* 12 GPM

SHIPPING WEIGHT

* 3.3 LBS

ROUGH-IN:

DRAIN:



ANSI/A112.18.1M

Division of Fisher Manufacturing Company
P.O. Box 60 Tulare, CA 93725-0060 1900 "O" Street Tulare, CA 93274-6850
Phone 1-800-421-6162 FAX 800-8-FAUCET (800-832-8238)

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

063017

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"EWS8" WALL SHELVES - STAINLESS STEEL 18GA

W/ 1.5" REAR RISER

FEATURES:

- TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- FINISHED W/ A SAFETY STALLION FRONT EDGE
- 1-1/2" TURNED UP BACKSPLASH
- 12" OR 16" DEPTH
- SHIPPED KNOCKED-DOWN, EASY-TO-ASSEMBLE (MOST SHIP UPS)
- ALL MODELS ARE NSF CERTIFIED



EWS8-1236

CONSTRUCTION:

- STAINLESS STEEL SHELVES ARE TIG WELDED
- EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE

MATERIAL:

- SHELF: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- BRACKETS: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH



EWS8-1636

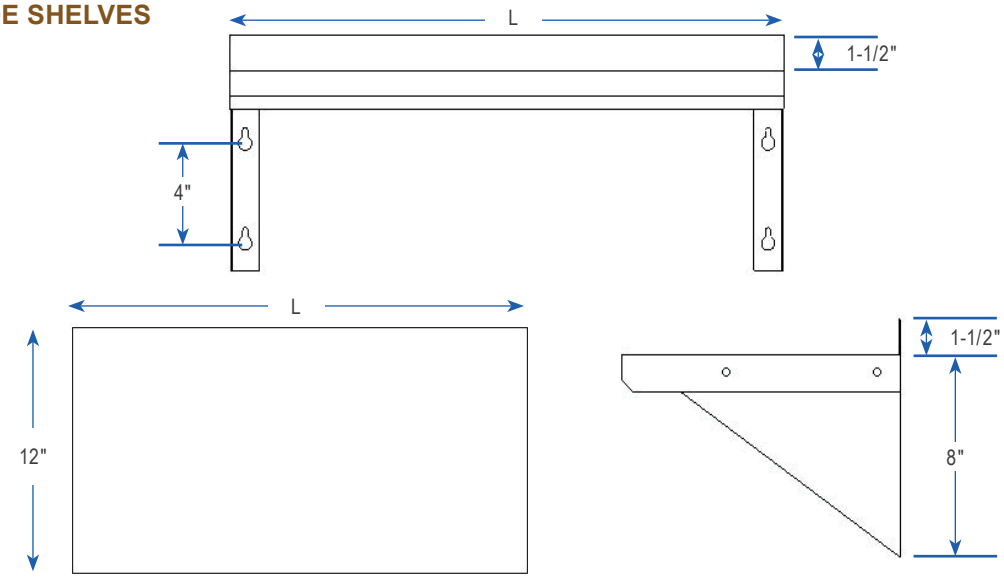
18GA STAINLESS STEEL F

12" WIDE	QTY	16" WIDE	QTY
EWS8-1224		EWS8-1624	
EWS8-1236		EWS8-1636	
EWS8-1248		EWS8-1648	
EWS8-1260		EWS8-1660	
EWS8-1272		EWS8-1672	
EWS8-1284		EWS8-1684	
EWS8-1296		EWS8-1696	

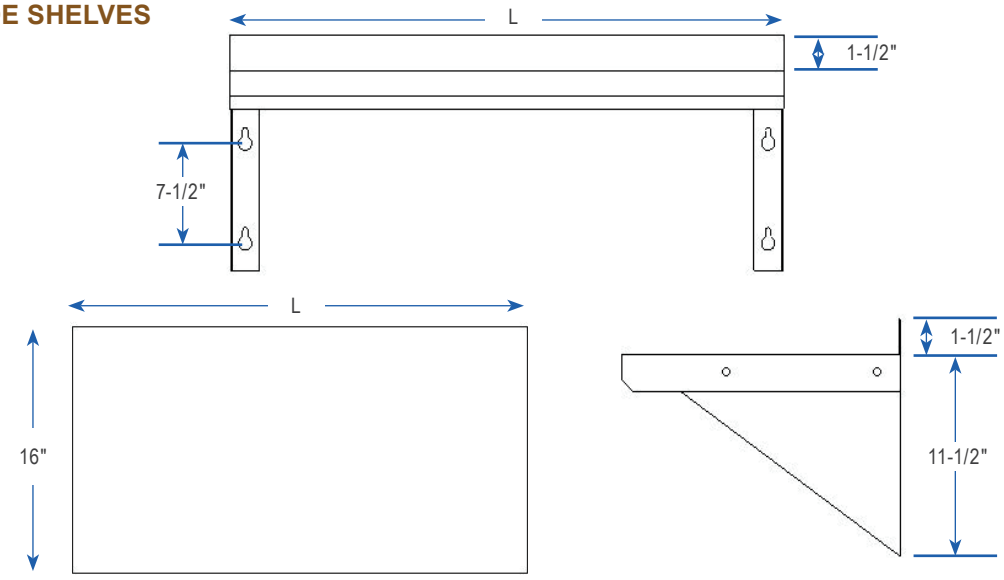
UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS.

DETAILED SPECIFICATIONS

12" WIDE SHELVES



16" WIDE SHELVES



18GA STAINLESS STEEL WALL SHELF

LENGTH	12" WIDE	WT. (LBS)	16" WIDE	WT. (LBS)
24"	EWS8-1224	8	EWS8-1624	10
36"	EWS8-1236	12	EWS8-1636	14
48"	EWS8-1248	16	EWS8-1648	18
60"	EWS8-1260	21	EWS8-1660	24
72"	EWS8-1272	25	EWS8-1672	30
84"	EWS8-1284	29	EWS8-1684	35
96"	EWS8-1296	33	EWS8-1696	38

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

063017

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"EWS8" WALL SHELVES - STAINLESS STEEL 18GA

W/ 1.5" REAR RISER

FEATURES:

- TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- FINISHED W/ A SAFETY STALLION FRONT EDGE
- 1-1/2" TURNED UP BACKSPLASH
- 12" OR 16" DEPTH
- SHIPPED KNOCKED-DOWN, EASY-TO-ASSEMBLE (MOST SHIP UPS)
- ALL MODELS ARE NSF CERTIFIED



EWS8-1236

CONSTRUCTION:

- STAINLESS STEEL SHELVES ARE TIG WELDED
- EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE

MATERIAL:

- SHELF: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- BRACKETS: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH



EWS8-1636

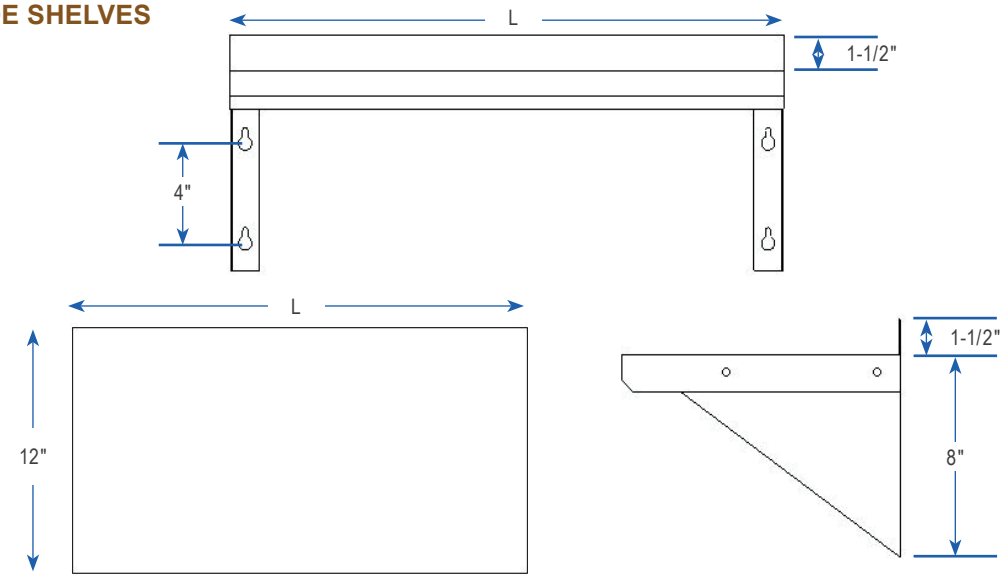
18GA STAINLESS STEEL F

12" WIDE	QTY	16" WIDE	QTY
EWS8-1224		EWS8-1624	
EWS8-1236		EWS8-1636	
EWS8-1248		EWS8-1648	
EWS8-1260		EWS8-1660	
EWS8-1272		EWS8-1672	
EWS8-1284		EWS8-1684	
EWS8-1296		EWS8-1696	

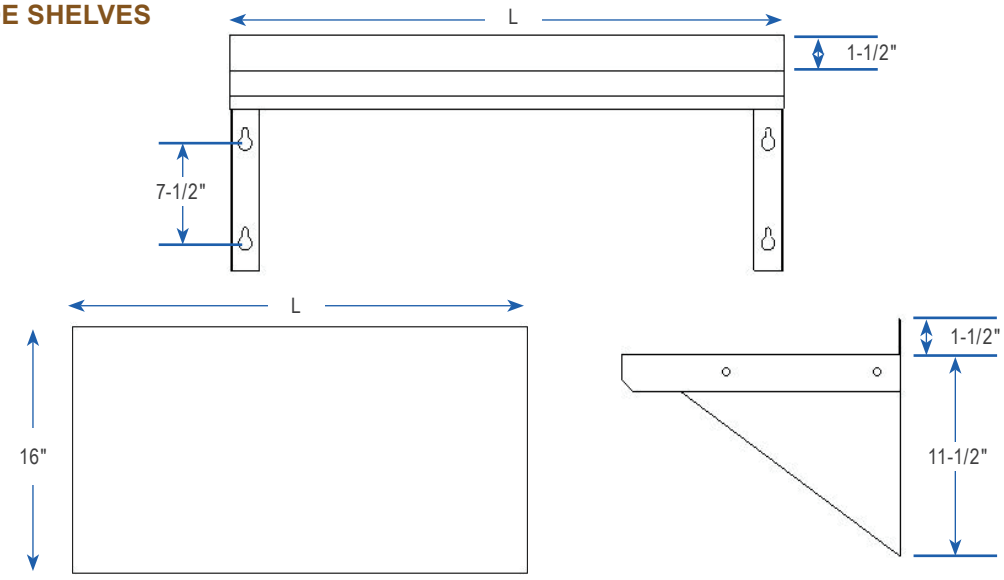
UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS.

DETAILED SPECIFICATIONS

12" WIDE SHELVES



16" WIDE SHELVES



18GA STAINLESS STEEL WALL SHELF

LENGTH	12" WIDE	WT. (LBS)	16" WIDE	WT. (LBS)
24"	EWS8-1224	8	EWS8-1624	10
36"	EWS8-1236	12	EWS8-1636	14
48"	EWS8-1248	16	EWS8-1648	18
60"	EWS8-1260	21	EWS8-1660	24
72"	EWS8-1272	25	EWS8-1672	30
84"	EWS8-1284	29	EWS8-1684	35
96"	EWS8-1296	33	EWS8-1696	38

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

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John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

031819

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PBHS-14" PRO-BOWL HAND SINKS

FOR SPLASH MOUNT FAUCETS

FEATURES:

- ONE PIECE DEEP DRAWN BOWL
- ALL SINK BOWLS HAVE LARGE LIBERAL RADII CORNERS
- INCLUDES BASKET DRAIN
- SPLASH MOUNT FAUCET HOLES 4" ON-CENTER
- 1-1/2" DRAIN PLUMBING CONNECTION

CONSTRUCTION:

- BOWL: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.

MATERIAL:

- BOWL: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH
- BRACKET: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH



PBHS-W-1410



PBHS-W-1410-P



PBHS-W-1410-SSLR



PBHS-W-1410-SSR



PBHS-W-1410-P-SSLR



PBHS-W-1410-4D

PRO-BOWL HAND SINKS

MODEL #	QTY
PBHS-W-1410	
PBHS-W-1410-P	
PBHS-W-1410-SSL	
PBHS-W-1410-SSR	
PBHS-W-1410-SSLR	
PBHS-W-1410-P-SSLR	
PBHS-W-1410-4D	
PBHS-W-1410-PD	

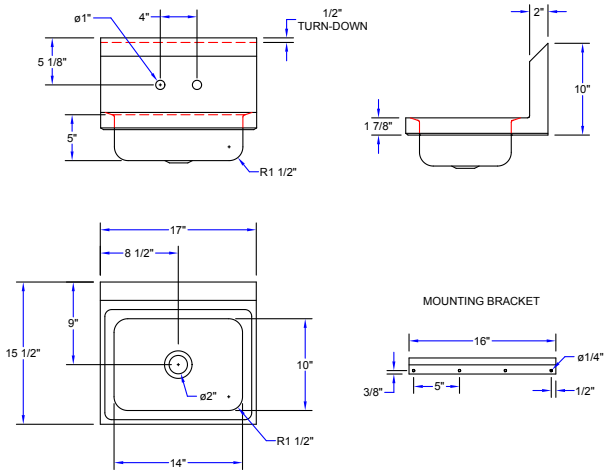
-P INCLUDES FAUCET

OPTIONAL ACCESSORIES

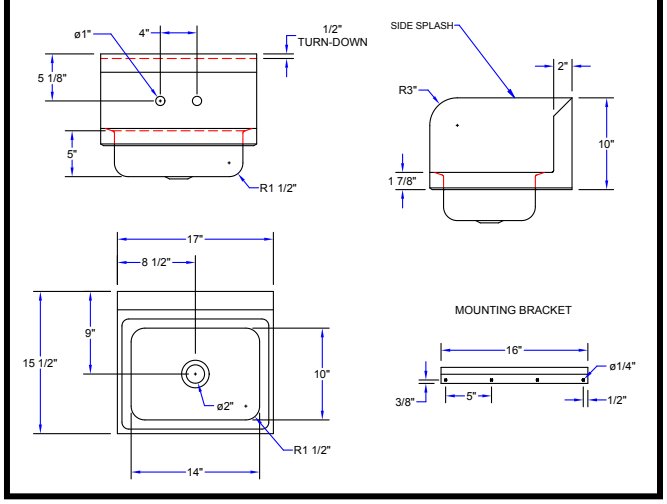
DESCRIPTION	QTY
FAUCETS	
SIDE SPASH	
ADA WRIST BLADES	
TOWEL DISPENSER	
LEVER WASTES	
OVER FLOWS	
P-TRAPS	

DETAILED SPECIFICATIONS

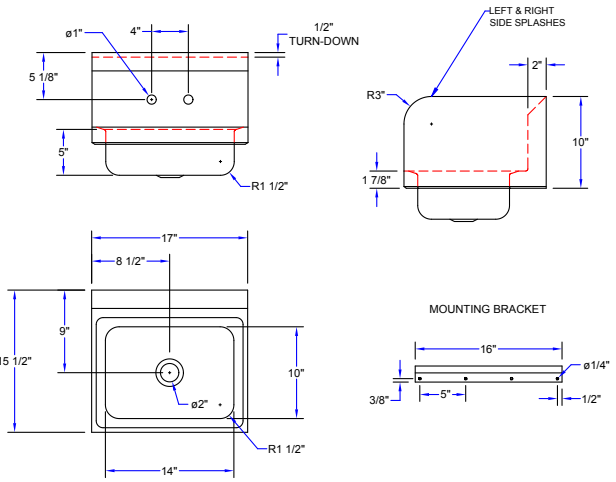
PBHS-W-1410



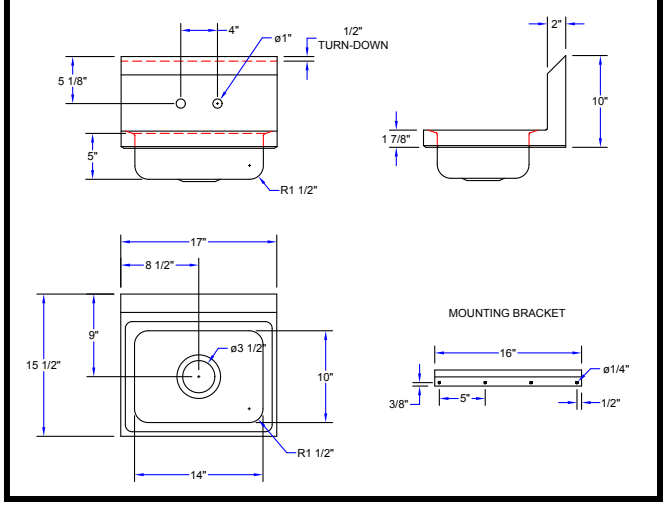
PBHS-W-1410-SSL, PBHS-W-1410-SSR



PBHS-W-1410-SSLR



PBHS-W-1410-4D



PRO-BOWL HAND SINKS

MODEL #	BOWL SIZE (LxWxD)	DRAIN SIZE	FAUCET LOCATION	SIDE SPLASH
PBHS-W-1410	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	N/A
PBHS-W-1410-P	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-SSL	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH
PBHS-W-1410-SSR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	RH
PBHS-W-1410-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH & RH
PBHS-W-1410-P-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	LH & RH
PBHS-W-1410-4D	14" X 10" X 5"	3-1/2"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-PD	14" X 10" X 5"	1-7/8"	DECK MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

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APPLICATION:

PRODUCT NAME: FAUCET 4BSLH

JOB NAME:

QUANTITY: | ITEM NO.:

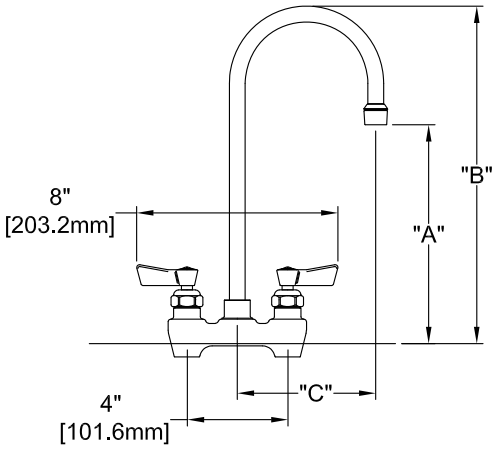
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

- ☐ 3616 FAUCET 4BSLH 12RGN PER 2.20 GPM
- ☐ 2003 FAUCET 4BSLH 06RGN PER 2.20 GPM
- ☐ 85391 FAUCET 4BSLH 10RGN PER 2.20 GPM
- ☐ 73370 FAUCET 4BSLH 12RGN PCA SPRAY 0.35 GPM
- ☐ 73371 FAUCET 4BSLH 06RGN PCA SPRAY 0.35 GPM

OPTIONS OR MODIFICATIONS:

- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ IN-LINE DUAL CHECK VALVE
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____



MODEL	DIM "A"	DIM "B"	DIM "C"
3615	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
1996	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]
85391	6 1/4" [159.0mm]	10 1/2" [266.2mm]	5" [127.0mm]
73370	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
73371	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]

FEATURES:

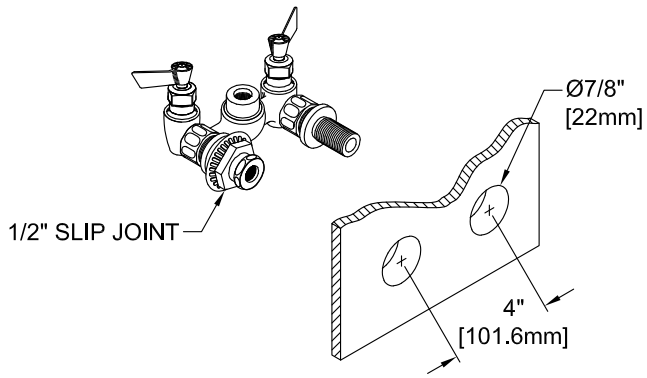
CONTROL VALVE
* 4" C/C BACKSPLASH
* INTERNAL SPRING LOADED CHECK VALVES
* SWIVELING SEAT DISKS
* HOT SIDE STEM - LEFT HAND
* COLD SIDE STEM - RIGHT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT INCLUDED

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 160°F MAX.
* PRESSURE 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 4.5 LBS

PRODUCT COMPLIANCE:
* ASME A112.18.1 / CSA B125.1
* NSF 61 - Section 9
* NSF 372 (Low Lead Content)

ROUGH-IN:



FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. FAHB-HW-4BSLL

"Clean Straight Dishtables" Pro-Bowl

Item #	_____	**Qty**____
Model #	_____	
Project	_____	



AUTOQUOTES

14 Gauge 304 16 Ga. Stainless Steel Legs	16 Gauge 304 16 Ga. Stainless Steel Legs	16 Gauge 304 Galvanized Legs
Premium	**Standard**	**Value**
CDT4-S24SBK-L or R	CDT6-S24SBK-L or R	CDT6-S24GBK-L or R
CDT4-S36SBK-L or R	CDT6-S36SBK-L or R	CDT6-S36GBK-L or R
CDT4-S48SBK-L or R	CDT6-S48SBK-L or R	CDT6-S48GBK-L or R
CDT4-S60SBK-L or R	CDT6-S60SBK-L or R	CDT6-S60GBK-L or R
CDT4-S72SBK-L or R	CDT6-S72SBK-L or R	CDT6-S72GBK-L or R
CDT4-S84SBK-L or R	CDT6-S84SBK-L or R	CDT6-S84GBK-L or R
CDT4-S96SBK-L or R	CDT6-S96SBK-L or R	CDT6-S96GBK-L or R
CDT4-S108SBK-L or R	CDT6-S108SBK-L or R	CDT6-S108GBK-L or R
CDT4-S120SBK-L or R	CDT6-S120SBK-L or R	CDT6-S120GBK-L or R
CDT4-S132SBK-L or R	CDT6-S132SBK-L or R	CDT6-S132GBK-L or R
CDT4-S144SBK-L or R	CDT6-S144SBK-L or R	CDT6-S144GBK-L or R

FEATURES:

Type 300 stainless steel with # 4 polish, satin finish

* Full length **10" High Boxed Backsplash**, with 2" return to wall at 45 degree and turned down rear lip
* All outside corners of assembly are Bullnosed to provide safe,clean and polished edge
* Standard legs 1-5/8" diameter,

Premium:

14 ga. 300 Series Stainless Steel Top
16 ga. 300 Stainless Steel Legs & Cross Bracing
Stainless Steel Bullet Feet

Standard:

16 ga. 300 Series Stainless Steel Top
16 ga. 300 Stainless Steel Legs & Cross Bracing
Stainless Steel Bullet Feet

Value:

16 ga. 300 Series Stainless Steel Top
Galvanized Legs & Cross Bracing
Galvanized Bullet Feet

CONSTRUCTION:

Top: Stainless Steel Tops are TIG welded, Exposed welds are polished to match adjacent surface.

OPTIONAL ACCESSORIES

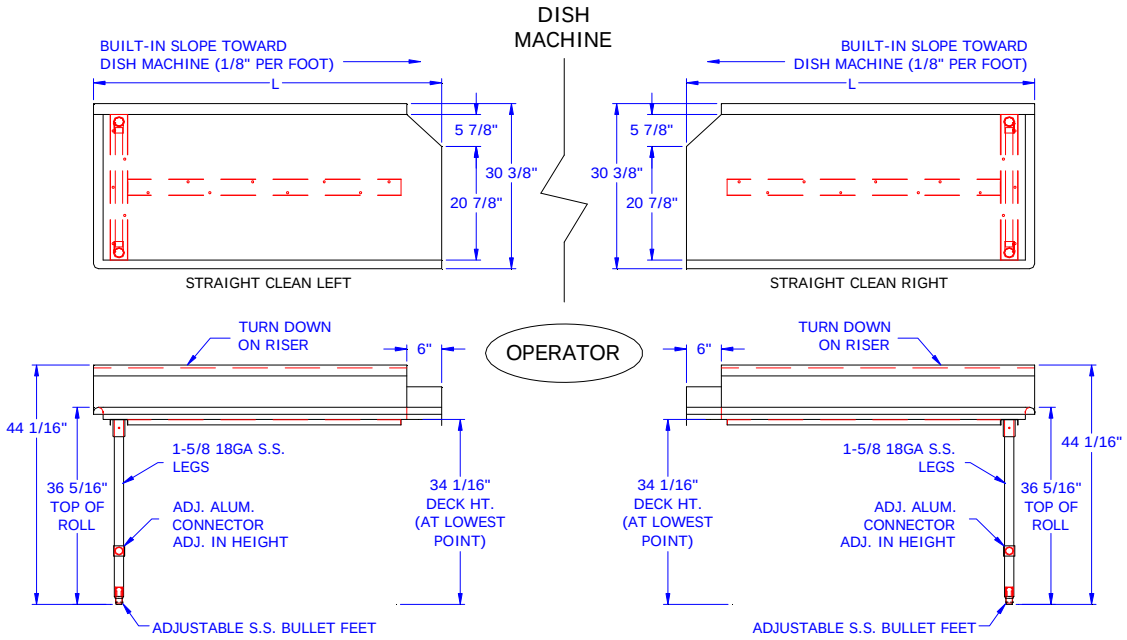
	MODEL #	Qty
Over Shelf		
Under Shelf		

MATERIAL:

Top: Stainless Steel
Type 300 stainless steel with # 4 polish, satin finish
Feet: 1" adjustable stainless steel bullet feet

John Boos & Co
3601 South Banker Street - Effingham, IL 62401
Phone: 217-347-7701 - Fax: 217-347-7705
Email: sales@johnboos.com - Web-site: www. johnboos.com

DETAILED SPECIFICATIONS



All units ship unasser

Units 7 ft. and larger are furnished with six legs.

All dimensions are typical.

Tolerance +/- .500".

	14 Gauge 304 16 Ga. Stainless Steel Legs		16 Gauge 304 16 Ga. Stainless Steel Legs		16 Gauge 304 Galvanized Legs	
L	Premium	Wt	Standard	Wt	Value	Wt
24	CDT4-S24SBK-L or R	46	CDT6-S24SBK-L or R	37	CDT6-S24GBK-L or R	37
36"	CDT4-S36SBK-L or R	59	CDT6-S36SBK-L or R	47	CDT6-S36GBK-L or R	47
48"	CDT4-S48SBK-L or R	78	CDT6-S48SBK-L or R	62	CDT6-S48GBK-L or R	62
60"	CDT4-S60SBK-L or R	90	CDT6-S60SBK-L or R	72	CDT6-S60GBK-L or R	72
72"	CDT4-S72SBK-L or R	109	CDT6-S72SBK-L or R	87	CDT6-S72GBK-L or R	87
84"	CDT4-S84SBK-L or R	130	CDT6-S84SBK-L or R	104	CDT6-S84GBK-L or R	104
96"	CDT4-S96SBK-L or R	143	CDT6-S96SBK-L or R	113	CDT6-S96GBK-L or R	114
108"	CDT4-S108SBK-L or R	174	CDT6-S108SBK-L or R	139	CDT6-S108GBK-L or R	139
120"	CDT4-S120SBK-L or R	205	CDT6-S120SBK-L or R	164	CDT6-S120GBK-L or R	164
132"	CDT4-S132SBK-L or R	236	CDT6-S132SBK-L or R	189	CDT6-S132GBK-L or R	189
144"	CDT4-S144SBK-L or R	268	CDT6-S144SBK-L or R	214	CDT6-S144GBK-L or R	214

S = Straight Dish Table
6 = 16. ga Work Surface
CDT = Clean Dishtable

60 = Total Length of Dishtable
SB = Stainless Legs & Bracing
K = K.D. w/ Adjustable Bracing

CDT6-S60SBK

John Boos & Co
3601 South Banker Street - Effingham, IL 62401 Phone: 217-347-7701 - Fax: 217-347-7705
Email: sales@johnboos.com - Web-site: www.johnboos.com

July 2013

John Boos is constantly engaged in a program of improving products and therefore reserves the right to change specification without prior notice

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

063017

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"EWS8" WALL SHELVES - STAINLESS STEEL 18GA

W/ 1.5" REAR RISER

FEATURES:

- TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- FINISHED W/ A SAFETY STALLION FRONT EDGE
- 1-1/2" TURNED UP BACKSPLASH
- 12" OR 16" DEPTH
- SHIPPED KNOCKED-DOWN, EASY-TO-ASSEMBLE (MOST SHIP UPS)
- ALL MODELS ARE NSF CERTIFIED



EWS8-1236

CONSTRUCTION:

- STAINLESS STEEL SHELVES ARE TIG WELDED
- EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE

MATERIAL:

- SHELF: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- BRACKETS: 18 GAUGE TYPE 430 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH



EWS8-1636

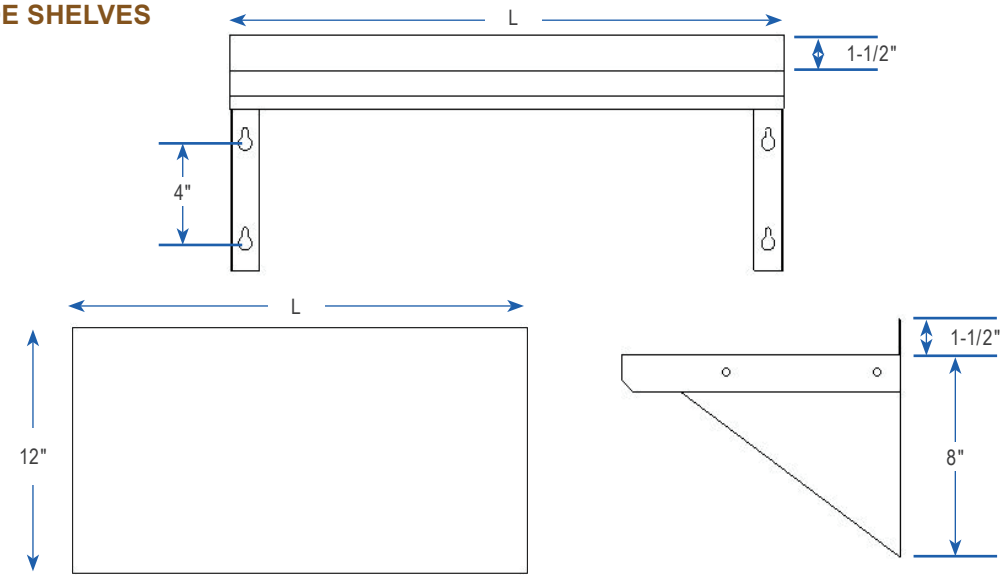
18GA STAINLESS STEEL F

12" WIDE	QTY	16" WIDE	QTY
EWS8-1224		EWS8-1624	
EWS8-1236		EWS8-1636	
EWS8-1248		EWS8-1648	
EWS8-1260		EWS8-1660	
EWS8-1272		EWS8-1672	
EWS8-1284		EWS8-1684	
EWS8-1296		EWS8-1696	

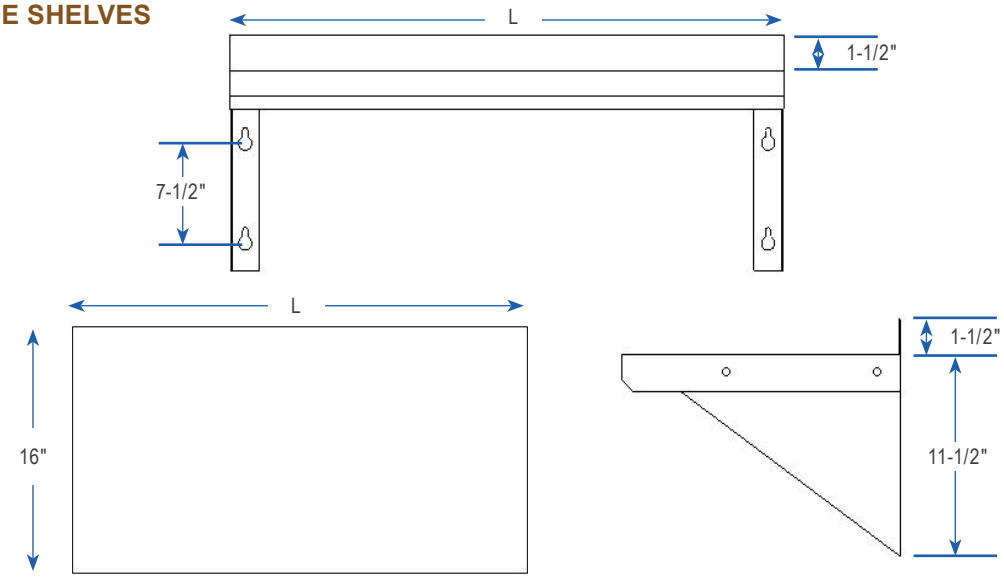
UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS.

DETAILED SPECIFICATIONS

12" WIDE SHELVES



16" WIDE SHELVES



18GA STAINLESS STEEL WALL SHELF

LENGTH	12" WIDE	WT. (LBS)	16" WIDE	WT. (LBS)
24"	EWS8-1224	8	EWS8-1624	10
36"	EWS8-1236	12	EWS8-1636	14
48"	EWS8-1248	16	EWS8-1648	18
60"	EWS8-1260	21	EWS8-1660	24
72"	EWS8-1272	25	EWS8-1672	30
84"	EWS8-1284	29	EWS8-1684	35
96"	EWS8-1296	33	EWS8-1696	38

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

Jackson®
Warewashing Systems

TempStar®

Project _____
Item _____
Quantity _____
CSI Section 11400
Approval _____
Date _____

Models

TempStar®



Standard Features

- Multi-cycle timer (Extra Heavy, Heavy, Medium, Normal)
- Specially designed stainless steel nozzles provide superior cleaning action
- Built-in 70 °F (38.9 °C) rise booster heater with Sani-Sure™ final rinse system is standard; 40 °F (22.2 °C) rise booster heater is available but must be specified at time of order
- 17-1/4" (438 mm) door opening accepts 18" (457 mm) trays
- Interchangeable wash/rinse arms screw out for simple cleanup
- Auto tank fill
- Door actuated start
- Delime/manual wash switch
- Vent fan control - shuts vent fan off when machine is idle
- Low watt density electric wash tank heater
- Hi-limit thermostat and low water protection
- Top mounted controls for ease of operation
- Adjustable bullet feet
- Uses standard 20" X 20" (508 mm X 508 mm) racks
- Front dress panel
- Detergent/rinse additive signal connection fuse box
- Self-draining stainless steel pump
- Large scrap basket

Mandatory Specs

Specify:
Specify voltage _____
Specify booster size _____

Options

- ☐ Optional 40 °F (22.2 °C) rise booster heater is available at no additional cost (must be specified on P.O.)
- ☐ 460V Electrical
- ☐ Single Phase
- ☐ Pressure Regulator
- ☐ Drain Water Tempering Kit
- ☐ Scaltrol
- ☐ Water Hammer Arrestor
- ☐ Flanged Feet
- ☐ False Panel (for corner installations, kit required)
- ☐ Door Interlock
- ☐ Security Package

Accessories

- ☐ 36-Compartment Rack
  - ☐ 4-1/8" tall (105 mm)
  - ☐ 5-5/8" tall (143 mm)
  - ☐ 7" tall (178 mm)
- ☐ Combination Rack
- ☐ Peg Rack

Specifications

- Uses 0.89 gallons (3.37 liters) of water per rack
- Total automatic (normal) cycle - 57 seconds
- 63 (58)* racks per hour (normal) cycle
- 1 hp wash pump motor
- Single point connections for all utilities
- Field convertible from straight through to corner and vice versa (kit required)
- Field convertible from 3-phase to single-phase and vice versa (kit required)
- Durable stainless steel construction
- 1-year parts and labor warranty

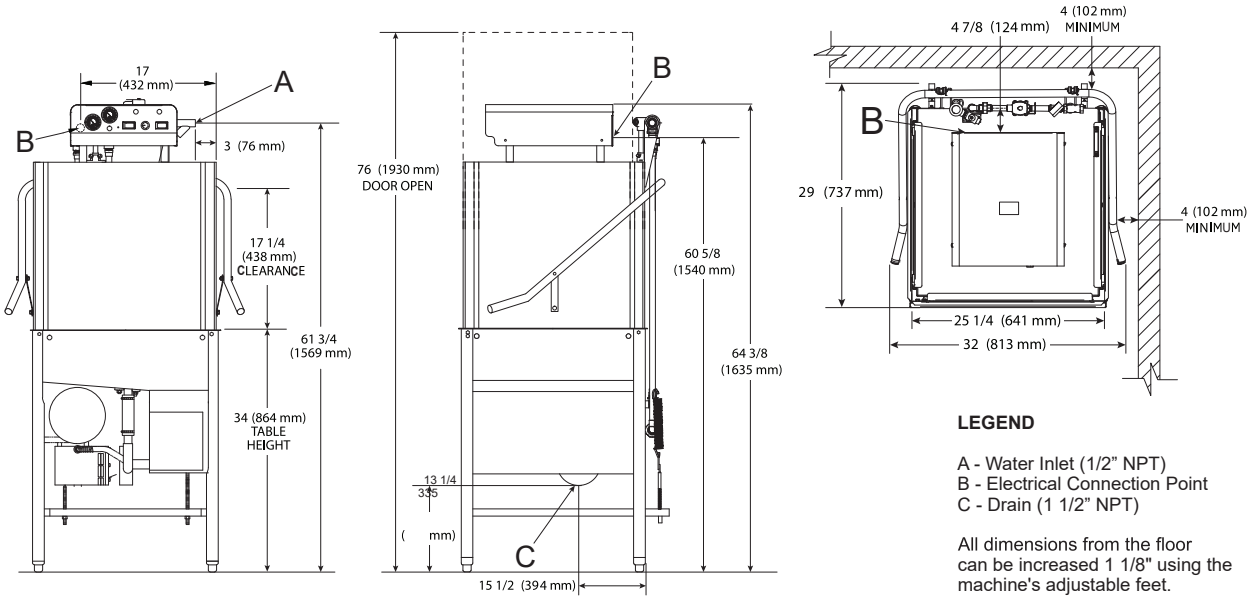
Intertek
Intertek
ENERGY STAR

Racks per hour calculated with NSF suggested load time of five (5) seconds for door-type (straight thru)

www.jacksonwws.com

Jackson®
Warewashing Systems

TempStar®



LEGEND

A - Water Inlet (1/2" NPT)
B - Electrical Connection Point
C - Drain (1 1/2" NPT)

All dimensions from the floor can be increased 1 1/8" using the machine's adjustable feet.

MODEL NO.	MACHINE DIMENSIONS				DRAIN HEIGHT	SHIPPING INFORMATION					
	HEIGHT	WIDTH	WIDTH BETWEEN TABLES	DEPTH		WEIGHT	CLASS	CUBE	HEIGHT	WIDTH	DEPTH
TempStar®	64-3/8" (1635 mm)	32" (813 mm)	25-1/4" (641 mm)	29" (737 mm)	13-1/4" (335 mm)	263 lbs (120 kg)	200	58.15 cu. ft.	72.5" (1842 mm)	33" (839 mm)	42" (1067 mm)

DIMENSIONS	
Wall Clearance (minimum)	4" (102 mm)
Standard Table Height	34" (864 mm)
Inside Clearance	17-1/4" (438 mm)
Machine Height with Door Open	76" (1933 mm)

OPERATING CAPACITY				
Cycle/Racks per Hour	Normal 63 (58)*	Medium 29 (30)*	Heavy 20 (19)*	Extra Heavy 12 (11)*
OPERATING CYCLE (seconds)	Wash	Rinse	Dwell	Total Cycle
Normal	40	10	7	57
Medium	100	10	7	117
Heavy	160	10	7	177
Extra Heavy	280	10	7	297

OPERATING TEMPERATURES	
Wash (minimum)	150 °F (66 °C)
Rinse (minimum)	180 °F (82 °C)

WATER	
Inlet Temperature	
40 °F (22.2 °C) Rise	140 °F (60 °C)
70 °F (38.9 °C) Rise	110 °F (43 °C)
No Booster	180 °F (82 °C)
Gallons per Rack	0.89 gal (3.37 L)
Gallons per Hour	56.07 gal (212.25 L)
Gallons per Hour**	51.62 gal (195.40 L)
Waterline Size IPS (minimum)	1/2"
Drainline Size IPS (minimum)	1- 1/2"
Flow Pressure (PSI)	10 ± 2
Wash Tank Capacity	8 gal (30.28 L)
Rinse Tank Capacity	2 gal (7.57 L)

HOW TO SPECIFY: TempStar®

ELECTRICAL	Power Supply	Total Load	Minimum Circuit Ampacity	Maximum Overcurrent Protection
With 70 °F Rise Booster	208/60/3	45.6 A	46.8 A	50 A
	230/60/3	49.8 A	51.1 A	55 A
	460/60/3	23.7 A	24.0 A	25 A
	208/60/1	75.2 A	76.5 A	80 A
	230/60/1	82.7 A	83.9 A	85 A
With 40 °F Rise Booster	208/60/3	41.4 A	42.6 A	45 A
	230/60/3	45.2 A	46.5 A	50 A
	460/60/3	21.4 A	21.7 A	25 A
	208/60/1	68.0 A	69.3 A	70 A
	230/60/1	74.7 A	75.9 A	80 A
With No Booster	208/60/3	16.4 A	17.6 A	20 A
	230/60/3	17.6 A	18.8 A	20 A
	460/60/3	7.5 A	7.8 A	15 A
	208/60/1	24.7 A	25.9 A	30 A
	230/60/1	26.8 A	28.0 A	30 A

WASH PUMP MOTOR	
208V/230V	1 hp
460V	3/4 hp

HEATERS			
Voltage	Electric Wash Tank Heater	Electric Rinse Tank Heater 40 °F (22.2 °C) Rise	Electric Rinse Tank Heater 70 °F (38.9 °C) Rise
208	4.1kW	9.0kW	10.5kW
230	5.0kW	11.0kW	12.9kW
460	5.0kW	11.0kW	12.9kW

*Racks per hour calculated with NSF suggested load time of five (5) seconds for door-type (straight thru)
**Gallons per hour calculated with NSF suggested load time of five (5) seconds for door-type (straight thru)

Jackson WWS, Inc.
Shipping Address: 6209 North U.S. Highway 25E, Gray, KY 40734
Mailing Address: P.O.Box 1060, Barbourville, KY 40906
Telephone: 888-800-5672 • Fax: 606-523-1799
Email: info@jacksonwws.com
07610-002-66-59 [02/22/21]

www.jacksonwws.com

We reserve the right to change specifications in this bulletin without incurring any obligation for equipment previously or subsequently sold.



The VHB Series is CaptiveAire's Premier Type II, Exhaust Only hood to be used over equipment not producing grease laden vapors. Type II hoods are used for condensation or heat removal applications.

Advantages

- **Exhaust Flow Rates:** Superior exhaust flow rates.
- **Construction:** Single wall type hood fabricated of Type 304 stainless steel, #3 or #4 polish, on all exposed surfaces when used in condensate applications. Type 430 stainless steel, #3 or #4 polish available when used for heat applications. Pre-punched hanging angles on each end of hood. Additional set provided for hoods longer than 12'.
- **Condensate Applications:** Integral 4-sided perimeter gutter and one drain standard for high-moisture exhaust.
- **Reduced Lead Times and Shipping Costs:** Produced on a high volume assembly line at one of five manufacturing facilities to reduce lead times and shipping costs.
- **Optional REM Construction:** Two options available when removable condensation baffles are required for heavy condensate applications. Designs available for one baffle or two baffle configuration to collect and drain condensation into gutter.
- **Optional Double Wall Construction:** Double wall front used when switches are needed on the face of the hood and/or lights are desired. Mechanical baffle provides a built-in wiring chase for optimal positioning of electrical controls and outlets on the front face of the hood.
- **Optional Lights:** Incandescent, LED and fluorescent lights are available.
- **Optional Make-Up Air:** Up to 80% make-up air can be supplied through optional front and/or side plenums (PSP Accessory).
- **Optional Enclosure Panels:** Constructed of stainless steel. Sized to extend from hood top to ceiling, enclosing pipe and hanging parts.

Performance

CONFIGURATION	LIGHT LOAD EXHAUST CFM / FT.	HEAVY LOAD EXHAUST CFM / FT.
Wall & 1-piece island	100	150

Recommended Duct Sizing: Exhaust - Based on 800 FPM

Features

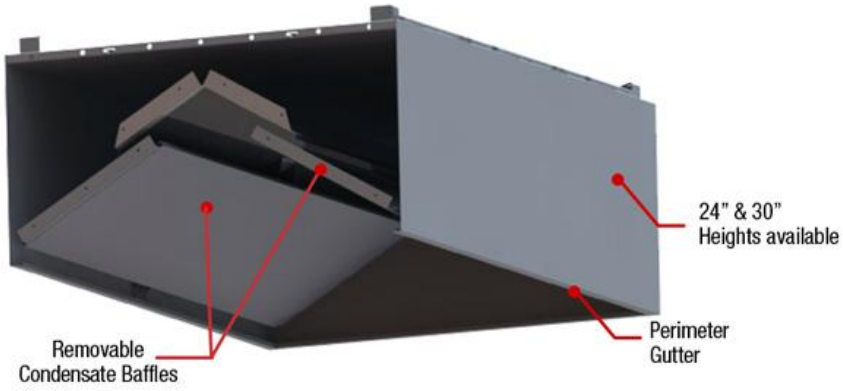
VHB Model



VHB Model with One REM Baffle



VHB Model with Two REM Baffles



Certifications

The VHB Model has been certified by ITS. This certification mark indicates that the product has been tested to and has met the minimum requirements of a widely recognized (consensus) U.S. and Canadian products safety standard, that the manufacturing site has been audited, and that the applicant has agreed to a program of periodic factory follow-up inspections to verify continued performance.

Models VHB are ETL Listed under file number 3186625SAT-001 and complies with UL710, ULC710 and ULC-S646 Standards.



John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

073118

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"SDT-I" SOILED ISLAND DISHTABLES PRO-BOWL

FEATURES:



- TYPE 300 STAINLESS STEEL WITH # 4 POLISH, SATIN FINISH
- 8" DEEP BOWLS (BOWL SIZE 20" X 20" X 8")
- BOTTOM OF BOWLS FORMED FOR DRAINAGE TO 3-1/2" DIAMETER DIE STAMPED OPENING
- FULL LENGTH **10" HIGH BOXED BACKSPLASH,** WITH 2" RETURN TO WALL AT 45 DEGREE AND 1/2" TURNED DOWN REAR LIP
- 1" FAUCET HOLES IN BACKSPLASH, 8" O/C
- ALL OUTSIDE CORNERS OF ASSEMBLY ARE BULLNOSED TO PROVIDE SAFE, CLEAN, AND POLISHED EDGE
- STANDARD 1-5/8" DIAMETER LEGS

CONSTRUCTION:

- TOP: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.

MATERIAL:

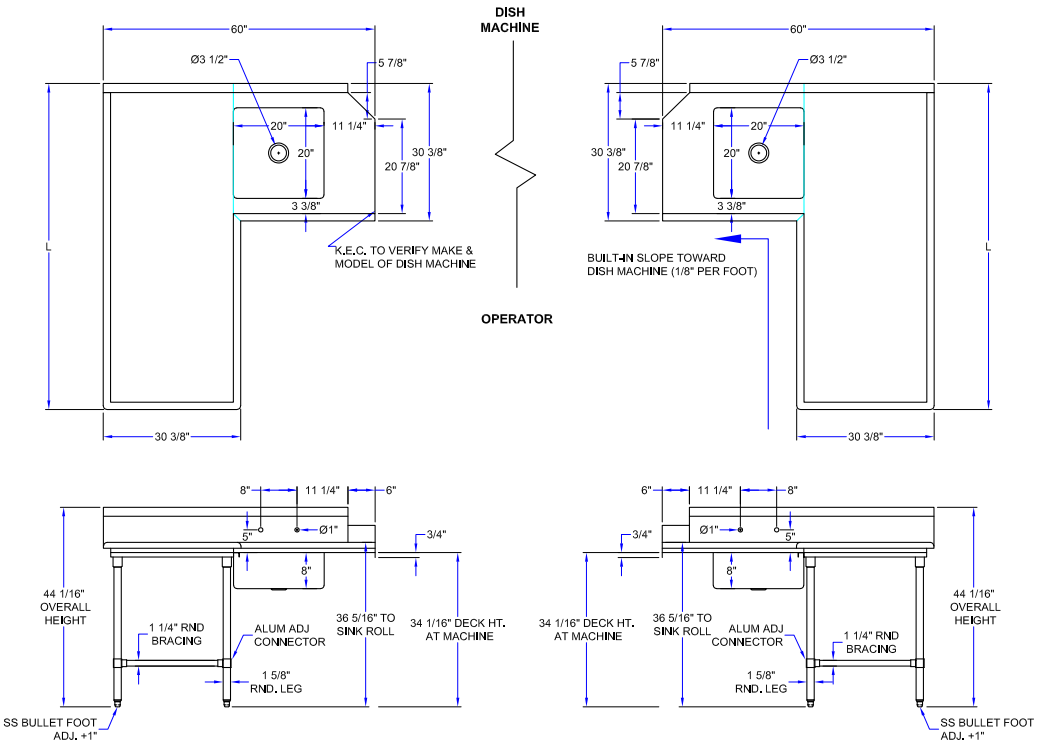
- TOP: STAINLESS STEEL
- FEET: 1" ADJUSTABLE STAINLESS STEEL BULLET FEET

14 GAUGE 304 16 GA. STAINLESS STEEL LEGS		16 GAUGE 304 16 GA. STAINLESS STEEL LEGS		16 GAUGE GALVANIZED LEGS	
PREMIUM	QTY	STANDARD	QTY	VALUE	QTY
SDT4-I6048SBK-L OR R		SDT6-I6048SBK-L OR R		SDT6-I6048GBK-L OR R	
SDT4-I6060SBK-L OR R		SDT6-I6060SBK-L OR R		SDT6-I6060GBK-L OR R	
SDT4-I6072SBK-L OR R		SDT6-I6072SBK-L OR R		SDT6-I6072GBK-L OR R	
SDT4-I6084SBK-L OR R		SDT6-I6084SBK-L OR R		SDT6-I6084GBK-L OR R	
SDT4-I6096SBK-L OR R		SDT6-I6096SBK-L OR R		SDT6-I6096GBK-L OR R	
SDT4-I60108SBK-L OR R		SDT6-I60108SBK-L OR R		SDT6-I60108GBK-L OR R	
SDT4-I60120SBK-L OR R		SDT6-I60120SBK-L OR R		SDT6-I60120GBK-L OR R	
SDT4-I60144SBK-L OR R		SDT6-I60144SBK-L OR R		SDT6-I60144GBK-L OR R	

OPTIONAL ACCESSORIES

DESCRIPTION	MODEL #	QTY
FAUCETS		
OVER SHELF		
UNDER SHELF		

DETAILED SPECIFICATIONS



- UNITS 7 FT. AND LARGER ARE FURNISHED WITH SIX LEGS.

	14 GAUGE 304 16 GA. STAINLESS STEEL LEGS		16 GAUGE 304 16 GA. STAINLESS STEEL LEGS		16 GAUGE GALVANIZED LEGS	
LENGTH	PREMIUM	WT. (LBS)	STANDARD	WT. (LBS)	VALUE	WT. (LBS)
48"	SDT4-I6048SBK-L OR R	200	SDT6-I6048SBK-L OR R	190	SDT6-I6048GBK-L OR R	190
60"	SDT4-I6060SBK-L OR R	220	SDT6-I6060SBK-L OR R	210	SDT6-I6060GBK-L OR R	210
72"	SDT4-I6072SBK-L OR R	240	SDT6-I6072SBK-L OR R	230	SDT6-I6072GBK-L OR R	230
84"	SDT4-I6084SBK-L OR R	255	SDT6-I6084SBK-L OR R	245	SDT6-I6084GBK-L OR R	245
96"	SDT4-I6096SBK-L OR R	275	SDT6-I6096SBK-L OR R	265	SDT6-I6096GBK-L OR R	265
108"	SDT4-I60108SBK-L OR R	295	SDT6-I60108SBK-L OR R	285	SDT6-I60108GBK-L OR R	285
120"	SDT4-I60120SBK-L OR R	310	SDT6-I60120SBK-L OR R	300	SDT6-I60120GBK-L OR R	300
144"	SDT4-I60144SBK-L OR R	350	SDT6-I60144SBK-L OR R	340	SDT6-I60144GBK-L OR R	340

MODEL # STRUCTURE

60 = TOTAL WIDTH OF DISHTABLE
I = ISLAND DISHTABLE
6 = 16GA WORK SURFACE
SDT = SOILED DISHTABLE

120 = LENGTH
SB = STAINLESS LEGS & BRACING
K = K.D. W/ ADJUSTABLE BRACING
L OR R = LEFT OR RIGHT DISHTABLE

SDT6-I60120SBK-L

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"
John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

PRODUCT NAME:

PRE-RINSE SPRING STYLE WALL MOUNT

JOB NAME:

QUANTITY: | ITEM NO.

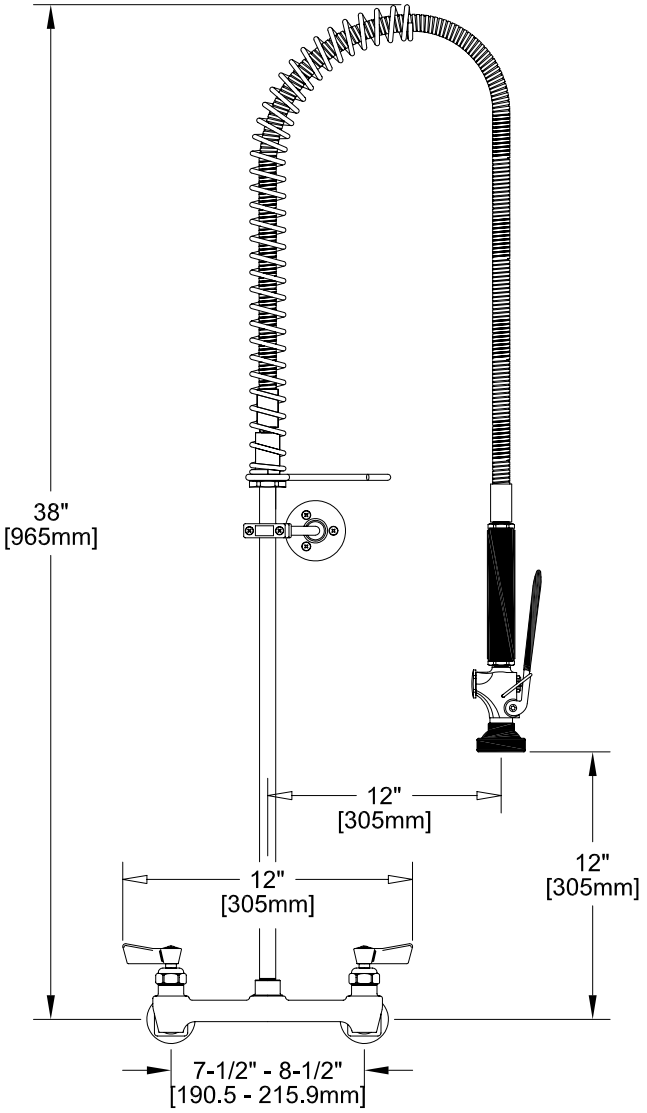
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

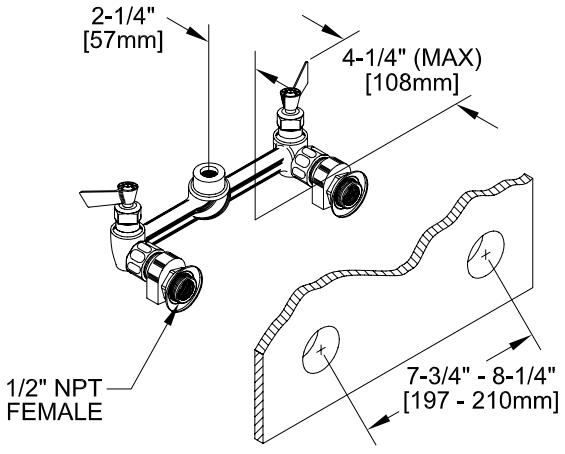
☐ 2210 ULTRA SPRAY VALVE, NO WALL BRACKET
☐ 2210-WB ULTRA SPRAY VALVE, WALL BRACKET

OPTIONS OR MODIFICATIONS:

☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
☐ ADD-ON FAUCET (6", 8", 10", 12", 14", 16") CIRCLE
☐ IN-LINE DUAL CHECK VALVE
☐ BRUSH
☐ NIPPLES
☐ ELBOWS
☐ VANDAL RESISTANT KIT
☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
☐ OTHER _____



ROUGH-IN:



FEATURES

CONTROL VALVE
* ECCENTRICS ADJUST FROM 7-3/4" TO 8-1/4"
* INTERNAL SPRING LOADED CHECK VALVES
* SWIVELLING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS

HOSE
* 36" LENGTH
* STAINLESS STEEL END FITTINGS
* STAINLESS STEEL EXTERNAL JACKET
* 3 PLY FIBER REINFORCED INTERNAL RUBBER HOSE
* REPAIRABLE IN FIELD WITH SIMPLE TOOLS

ULTRA SPRAY VALVE
* LOWEST ENERGY USER - 1.15 GPM @ 60 PSI
* CLEANS FASTER - TEST PROVEN
* ENGINEERED TO LAST - NO 'O' RINGS TO LEAK
* INTERCHANGEABLE - FITS ALL BRANDS

WALL BRACKET
* ADJUSTS FROM 2" TO 12"

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 12.0 LBS

EPAct 2005 Compliant ANSI/A112.18.1M

FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 2210 REV. E

APPLICATION:

PRODUCT NAME:

ADD-ON FAUCET WITH SWING SPOUT

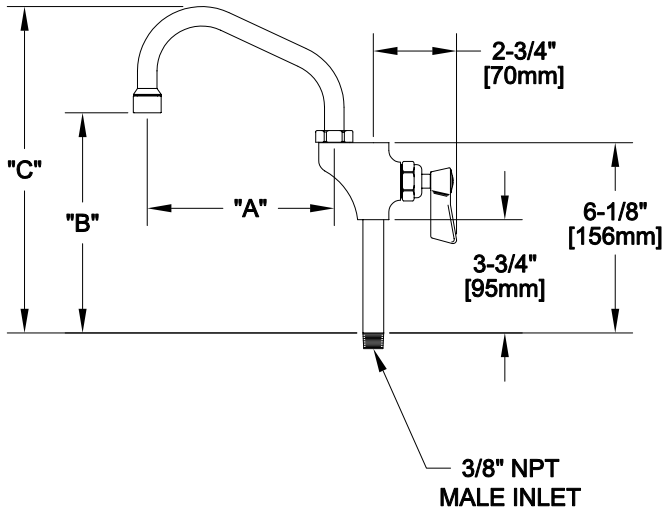
JOB NAME:

QUANTITY: | ITEM NO.

SPECIAL CONFIGURATION
☐ _____ CHECK BASE MODEL AND OPTIONS

MODEL:
- ☐ 2901 WITH 6" SWING SPOUT
- ☐ 2901-8 WITH 8" SWING SPOUT
- ☐ 2901-10 WITH 10" SWING SPOUT
- ☐ 2901-12 WITH 12" SWING SPOUT
- ☐ 2901-14 WITH 14" SWING SPOUT
- ☐ 2901-16 WITH 16" SWING SPOUT

OPTIONS OR MODIFICATIONS:
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ VANDAL RESISTANT KIT
- ☐ OTHER _____



FEATURES

CONTROL VALVE
* 3/8" MALE INLET
* STEM - RIGHT HAND
* HOT AND COLD INDEX BUTTONS
* SWIVELLING SEAT DISK
* STAINLESS STEEL SEAT
* STAINLESS STEEL SEAT SCREW
* STAINLESS STEEL HANDLE SCREW

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 2.5 LBS

MODEL	DIM "A"	DIM "B"	DIM "C"
2901	6" [152mm]	7-1/8" [181mm]	10-3/4" [273mm]
2901-8	8" [204mm]	8" [204mm]	11-5/8" [296mm]
2901-10	10" [254mm]	7-1/2" [191mm]	11" [280mm]
2901-12	12" [305mm]	8-3/4 [222mm]	12-3/8" [314mm]
2901-14	14" [356mm]	9-3/8" [239mm]	13" [330mm]
2901-16	16" [406mm]	10" [255mm]	13-5/8" [347mm]

ANSI/A112.18.1M

SPEC. 2901 REV. C

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SALVAJOR® Food Waste Disposer 1 HP - Model 100

JOB: _____ **Item No.:** _____



SPECIFICATIONS:

CORROSION RESISTANT BODY
Permanent molded from heat treated aluminum alloy.

EXTENDED LIP WATER SEAL
Protects the motor from damage by water.

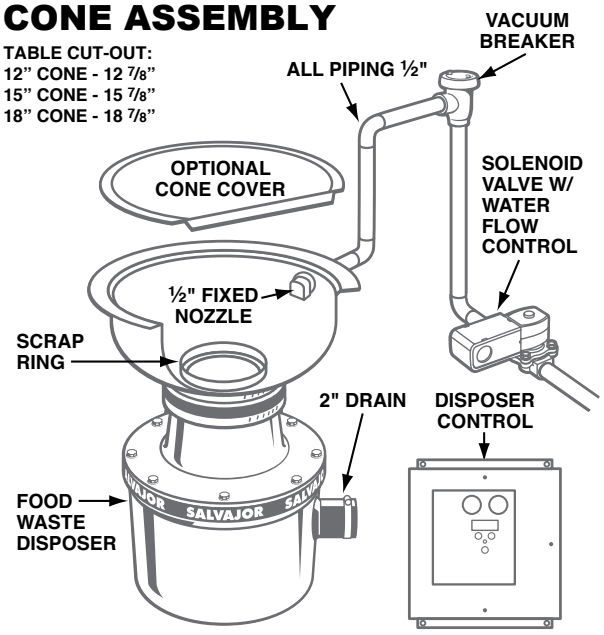
TAPERED ROLLER BEARING
Provides longer motor life, quiet operation and shock absorbing.

WATER COOLED MOTOR
Provides maximum efficiency and longer life.

QUIET OPERATION
Extra thick rubber mounting adaptor and drain outlet isolates sound and eliminates vibration.

CONE ASSEMBLY

TABLE CUT-OUT:
12" CONE - 12 7/8"
15" CONE - 15 7/8"
18" CONE - 18 7/8"



NOTE: INSTALL PER ALL APPLICABLE CODES

NEMA 4 Watertight Controls



MSS



MRSS



ARSS-2



ARSS

Optional Line Disconnect (LD) available on MSS, MRSS, & ARSS

FULL LOAD AMPS

❑	115 Volts	1 Phase	18.6 Amps
❑	208 Volts	1 Phase	10.2 Amps
❑	230 Volts	1 Phase	9.3 Amps
❑	208 Volts	3 Phase	4.9 Amps
❑	230 Volts	3 Phase	4.5 Amps
❑	460 Volts	3 Phase	2.3 Amps

◆ SPECIFY EXACT OPERATING VOLTAGE ◆

Model 100 Food Waste Disposer

1 HP - 1 Phase & 3 Phase

SPECIFICATIONS:

MOUNTING – Rubber adaptor above grind chamber and rubber drain outlet isolates sound and eliminates vibration. No metal to metal contact.

EXTERIOR HOUSING – Permanent molded from heat treated, corrosion resistant aluminum alloy then computer machined to a smooth polished finish. Paint free.

SHREDDER – 8 inch diameter, machined high strength, wear resistant hardened carbide alloy.

ROTOR – 8 inch diameter with 2 cutter bars, machined high strength, wear resistant hardened carbide alloy.

MOTOR – 1 HP totally enclosed. Water cooled for efficiency and longer life. Built-in manual reset thermal overload protection. Available in 208 volts or 115/230 volts, 60 cycle, 1 phase and 208-230/460 volts, 60 cycle, 3 phase.

BEARINGS – Tapered roller (top)
Sealed ball (bottom)

SEAL – Extended Lip Water Seal.

WATER REQUIREMENT – 5 gallons of cold water per minute.

WASTE OUTLET – Rubber drain accepts 2" piping.

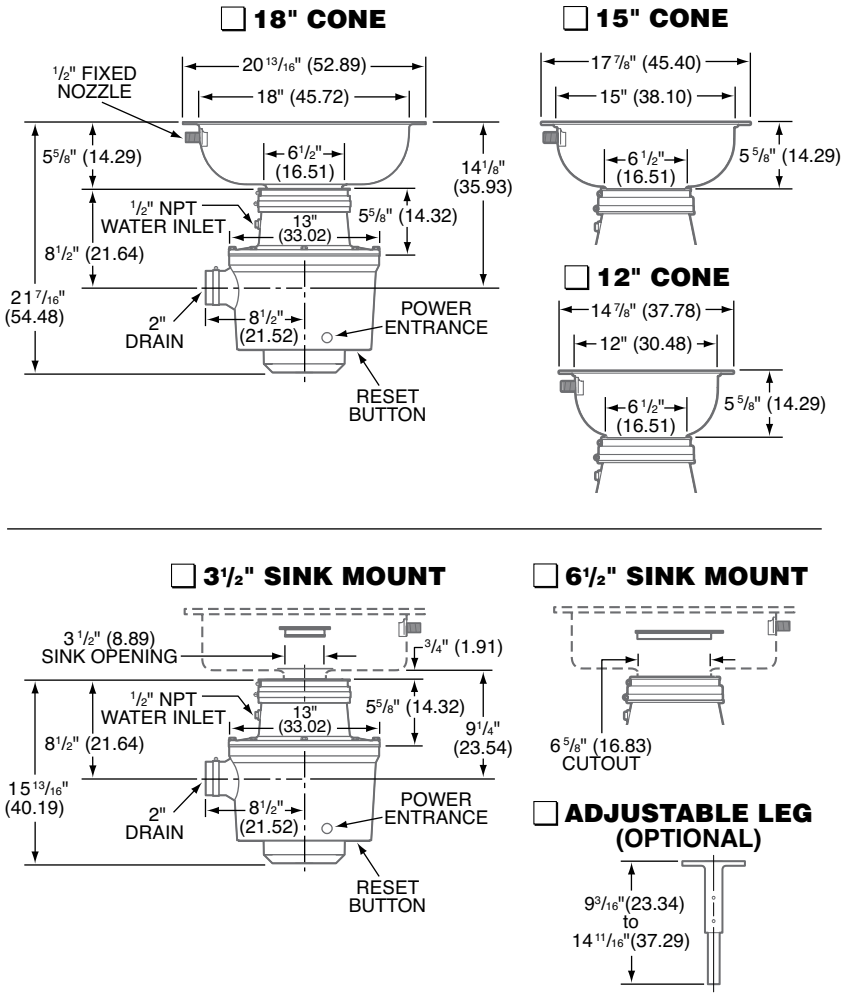
DUAL DIRECTION GRINDING – Designed to operate in either direction. Direction of rotation can be controlled when installed with automatic reversing controls. ***Reversing rotation can double cutting teeth life.***

LEG SUPPORT (Optional) – Single leg, adjustable.

ASSEMBLIES: (See Specification Sheet)
CA – Cone Assembly with 12", 15" or 18" Cone
SA – Sink Assembly with 3½" or 6½" Sink Collar

DISPOSER CONTROLS: (See Specification Sheet)
MSS: (Non Reversing)
MRSS: (Manual Reversing)
ARSS-2: (Automatic Reversing)
ARSS: (Automatic Reversing with Water Saver)

DIMENSIONS



NOTE: Dimensions in parenthesis are in centimeters
(Specifications subject to change without notice)
Current specification details may be found online at www.salvajor.com

SAMPLE SPECIFICATION

100-CA-18		MSS	(230/60/3)
Model	Cone Size	Disposer Control	Electrical Specs.
	Assembly		

◆ SPECIFY EXACT OPERATING VOLTAGE ◆

SALVAJOR

Manufacturers of Commercial Food Waste Solutions - *Since 1944*

4530 East 75th Terrace Kansas City, MO 64132-2081, USA
816.363.1030 | Toll Free: 1.800.725.8256 | Service: 1.888.725.8256 | Fax: 1.800.832.9373
sales@salvajor.com | service@salvajor.com | **www.salvajor.com**

Printed in USA
Form No.S100 (04-18)

SPEC SHEET

"PB-SRW" SORTING SHELVES

Solid Construction, Wall Mounted

FEATURES:
- Solid Sorting Wall Shelf
- Drainage Tube In Corner

SPECIFICATIONS:
- TIG Welded With Exposed Surfaces Blended To Match
- Brackets: 18GA Type 300 Stainless Steel
- Shelf: 18GA Type 300 Stainless Steel

CERTIFICATIONS:



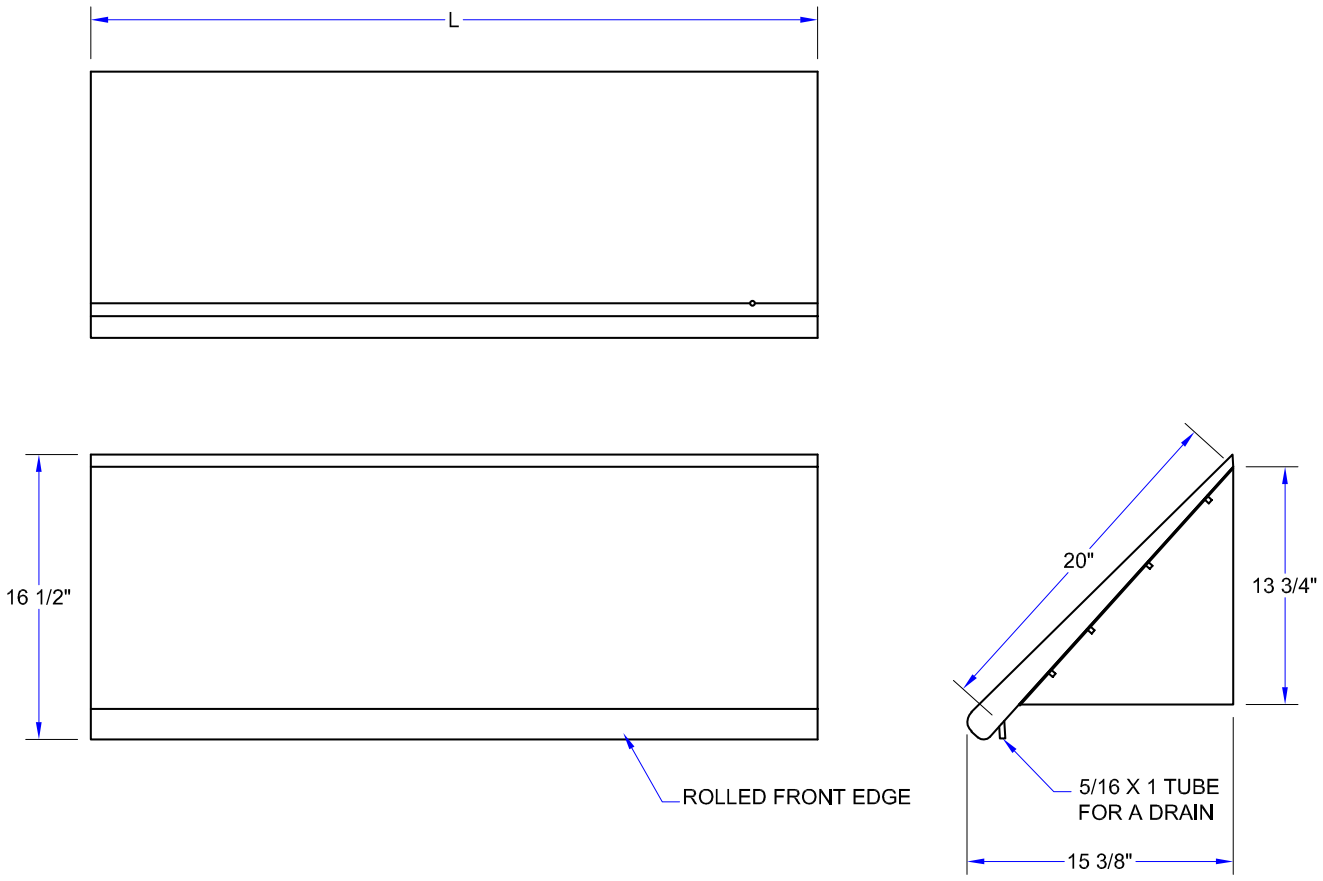
PB-SRW-21

"PB-SRW" SORTING SH ELVES

MODEL	SIZE (LXWXH)	WEIGHT (LBS)
PB-SRW-21	21"x15-3/8"x16-1/2"	5
PB-SRW-42	42"x15-3/8"x16-1/2"	10
PB-SRW-63	63"x15-3/8"x16-1/2"	28

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

DETAILED SPECIFICATIONS



"PB-SRW" SORTING SHELVES

MODEL	SIZE (LXWXH)	WEIGHT (LBS)
PB-SRW-21	21"x15-3/8"x16-1/2"	5
PB-SRW-42	42"x15-3/8"x16-1/2"	10
PB-SRW-63	63"x15-3/8"x16-1/2"	28

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

031819

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PBHS-14" PRO-BOWL HAND SINKS

FOR SPLASH MOUNT FAUCETS

FEATURES:

- ONE PIECE DEEP DRAWN BOWL
- ALL SINK BOWLS HAVE LARGE LIBERAL RADII CORNERS
- INCLUDES BASKET DRAIN
- SPLASH MOUNT FAUCET HOLES 4" ON-CENTER
- 1-1/2" DRAIN PLUMBING CONNECTION

CONSTRUCTION:

- BOWL: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.

MATERIAL:

- BOWL: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH
- BRACKET: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH



PBHS-W-1410



PBHS-W-1410-P



PBHS-W-1410-SSLR



PBHS-W-1410-SSR



PBHS-W-1410-P-SSLR



PBHS-W-1410-4D

PRO-BOWL HAND SINKS

MODEL #	QTY
PBHS-W-1410	
PBHS-W-1410-P	
PBHS-W-1410-SSL	
PBHS-W-1410-SSR	
PBHS-W-1410-SSLR	
PBHS-W-1410-P-SSLR	
PBHS-W-1410-4D	
PBHS-W-1410-PD	

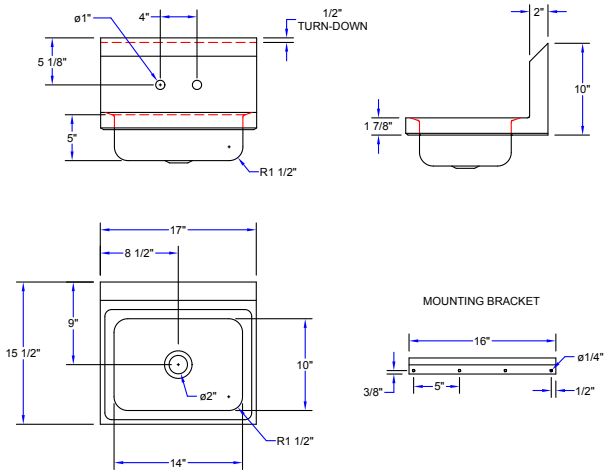
-P INCLUDES FAUCET

OPTIONAL ACCESSORIES

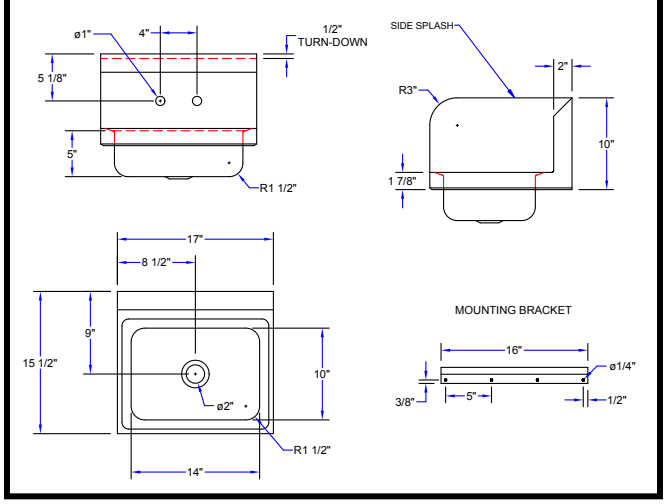
DESCRIPTION	QTY
FAUCETS	
SIDE SPASH	
ADA WRIST BLADES	
TOWEL DISPENSER	
LEVER WASTES	
OVER FLOWS	
P-TRAPS	

DETAILED SPECIFICATIONS

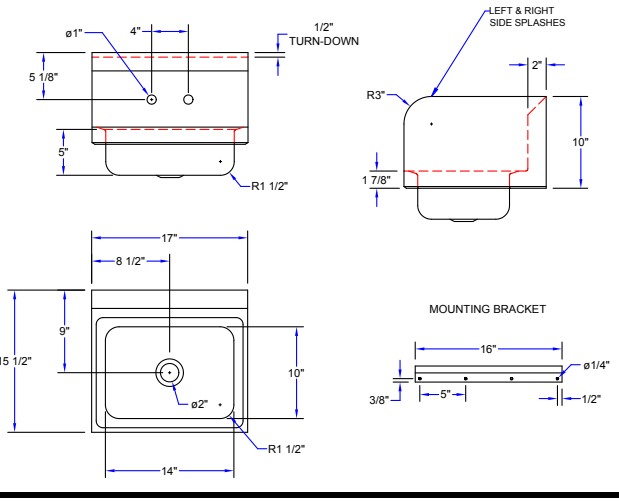
PBHS-W-1410



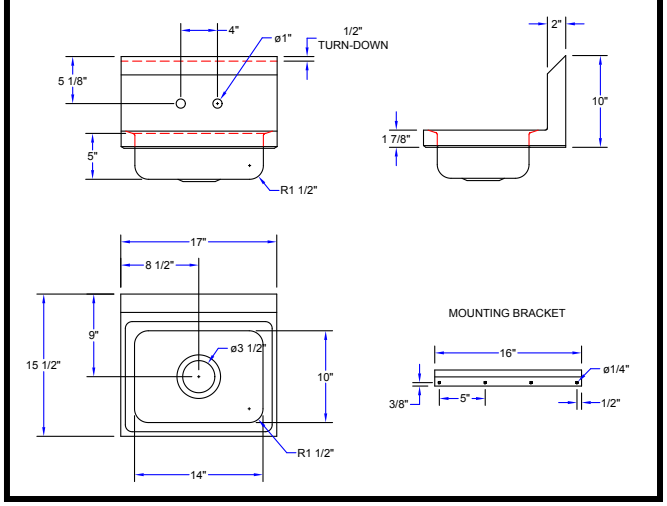
PBHS-W-1410-SSL, PBHS-W-1410-SSR



PBHS-W-1410-SSLR



PBHS-W-1410-4D



PRO-BOWL HAND SINKS

MODEL #	BOWL SIZE (LxWxD)	DRAIN SIZE	FAUCET LOCATION	SIDE SPLASH
PBHS-W-1410	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	N/A
PBHS-W-1410-P	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-SSL	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH
PBHS-W-1410-SSR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	RH
PBHS-W-1410-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH & RH
PBHS-W-1410-P-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	LH & RH
PBHS-W-1410-4D	14" X 10" X 5"	3-1/2"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-PD	14" X 10" X 5"	1-7/8"	DECK MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

PRODUCT NAME: FAUCET 4BSLH

JOB NAME:

QUANTITY: | ITEM NO.:

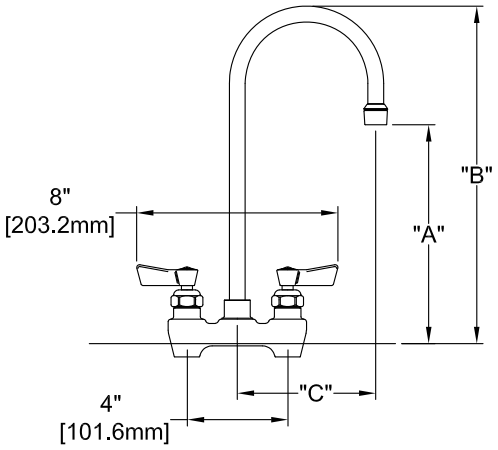
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

- ☐ 3616 FAUCET 4BSLH 12RGN PER 2.20 GPM
- ☐ 2003 FAUCET 4BSLH 06RGN PER 2.20 GPM
- ☐ 85391 FAUCET 4BSLH 10RGN PER 2.20 GPM
- ☐ 73370 FAUCET 4BSLH 12RGN PCA SPRAY 0.35 GPM
- ☐ 73371 FAUCET 4BSLH 06RGN PCA SPRAY 0.35 GPM

OPTIONS OR MODIFICATIONS:

- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ IN-LINE DUAL CHECK VALVE
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____



MODEL	DIM "A"	DIM "B"	DIM "C"
3615	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
1996	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]
85391	6 1/4" [159.0mm]	10 1/2" [266.2mm]	5" [127.0mm]
73370	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
73371	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]

FEATURES:

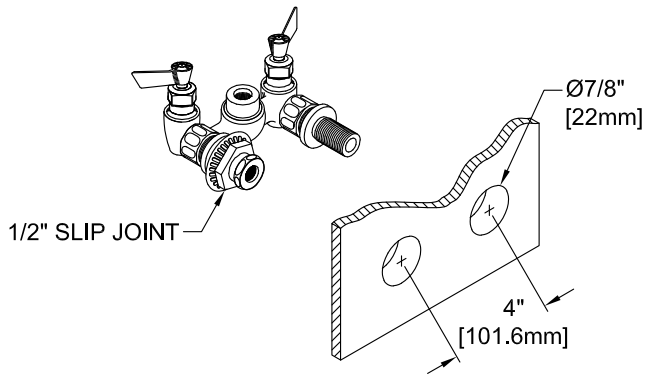
CONTROL VALVE
* 4" C/C BACKSPLASH
* INTERNAL SPRING LOADED CHECK VALVES
* SWIVELING SEAT DISKS
* HOT SIDE STEM - LEFT HAND
* COLD SIDE STEM - RIGHT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT INCLUDED

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 160°F MAX.
* PRESSURE 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 4.5 LBS

PRODUCT COMPLIANCE:
* ASME A112.18.1 / CSA B125.1
* NSF 61 - Section 9
* NSF 372 (Low Lead Content)

ROUGH-IN:



FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. FAHB-HW-4BSLL

WARING® COMMERCIAL IMMERSION BLENDERS

WARING COMMERCIAL

Heavy-Duty Big Stix®

Immersion Blenders, Whisk Attachment and Accessories





The Big Stix®

WSB50
12" Immersion Blender

WSB55
14" Immersion Blender

WSB60
16" Immersion Blender

WSB65
18" Immersion Blender

WSB70
21" Immersion Blender

WSBPPW
10" Stainless Steel Whisk

WARING COMMERCIAL

Heavy-Duty Big Stix® and Accessories

Specifications

Item	Electrical	Watts	Listings	Max RPM	Dimensions (H" x W" x D")	Warranty
WSB50	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	27" x 5" x 5.5"	Limited 1 Year
WSB55	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	29" x 5" x 5.5"	Limited 1 Year
WSB60	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	31" x 5" x 5.5"	Limited 1 Year
WSB65	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	33" x 5" x 5.5"	Limited 1 Year
WSB70	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	36" x 5" x 5.5"	Limited 1 Year
WSBPPW	120 Volt, 6.25 amps, 50/60 Hz	750	ETL, NSF	1,600	31" x 5" x 5.5"	Limited 1 Year

Ordering Information

Description	Catalog #	Std Pkg.	Ship Wt. (Lbs.)	Cubic Feet	UPC Code
12" Big Stik® Immersion Blender	WSB50	2	9.5	1.70	040072002137
14" Big Stik® Immersion Blender	WSB55	2	9.75	1.90	040072002120
16" Big Stik® Immersion Blender	WSB60	2	10.0	2.10	040072002113
18" Big Stik® Immersion Blender	WSB65	2	10.25	2.30	040072002878
21" Big Stik® Immersion Blender	WSB70	2	10.38	2.60	040072002885
12" Stainless Steel Shaft	WSB50ST	6	2.5	1.59	040072002540
14" Stainless Steel Shaft	WSB55ST	6	2.75	1.96	040072002557
16" Stainless Steel Shaft	WSB60ST	6	3.0	2.17	040072002564
18" Stainless Steel Shaft	WSB65ST	6	3.25	2.38	040072002922
21" Stainless Steel Shaft	WSB70ST	6	3.38	2.70	040072002939
10" Big Stik® Whisk	WSBPPW	2	22.0	2.94	040072008184
10" Whisk Attachment	WSB2W	4	18.2	1.20	040072009242
2 Stainless Steel Whipping Paddles	WSBWP	10	1.5	0.07	040072008504
Bowl Clamp	WSBBC	1	4.0	0.13	040072006937
Wall Mount Hanger	WSB01	64	32.1	1.66	040072002380
Big Stik® Power Pack	WSBPP	2	7.0	1.27	040072002649

Waring Commercial • 314 Ella T. Grasso Ave. • Torrington • Connecticut 06790
Tel. (800) 492-7464 • Fax (860) 496-9008 • www.waringproducts.com • ©2007 Waring

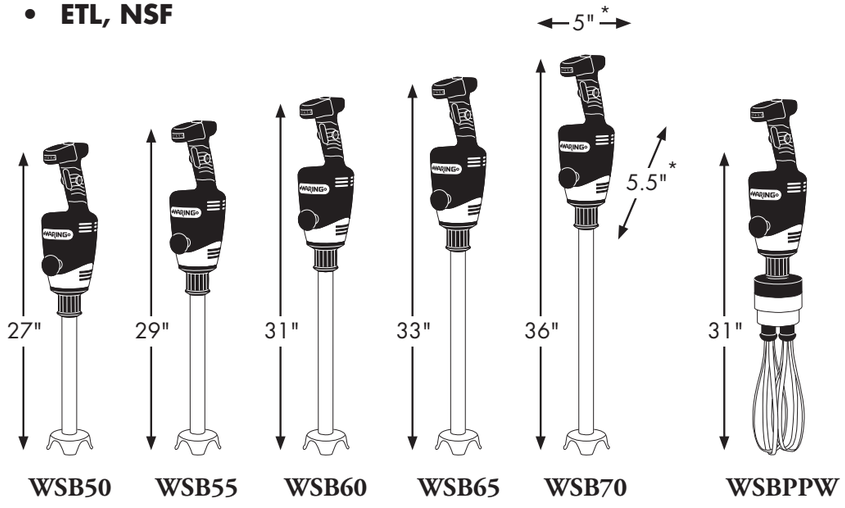
07WC30095
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Big Stik® Heavy-Duty Immersion Blenders

The high-efficiency variable speed motor that powers Waring's Big Stik® Immersion Blenders drives through the thickest ingredients to produce sauces, batters and soups in just minutes. Complete with rubberized comfort grip and second handle (patent pending), the lightweight, ergonomic design allows for safe and controlled operation during any job, large or small. The easily removable stainless steel shafts are available in five sizes (up to 21") and are completely sealed and dishwasher safe. With the Big Stik® line, you can mix, purée and emulsify up to 50 gallons. Blend smoothly, and carry the Big Stik®.

Features

- **Heavy-Duty Motor** – High efficiency 1 HP motor, 750 watts, 18,000 RPMs processing speed on high
- **Variable Speed Motor** – Unlimited speed adjustment from 5,000 – 18,000 RPMs provides full control and consistency, from light mixing to puréeing and emulsifying
- **Lightweight and Ergonomic** – Rubberized comfort grip and second handle allow for safe and controlled operation
- **Completely Sealed Shafts** – Stainless steel shafts are easily removable and dishwasher safe
- **Continuous On Operation**
- **Versatility** – All five stainless steel shafts are interchangeable with one universal motor housing (Power pack – WSBPP)
- **Limited One Year Warranty**
- **ETL, NSF**



* 5" width and 5.5" depth are the same for all five immersion blenders and whisk

WARING® COMMERCIAL IMMERSION BLENDERS

Optional Accessories

Waring makes it easy to do more than just blend. The 10" Stainless Steel Whisk Attachment quickly transforms the Big Stik® into a gentle giant as it whips delicate egg whites, creams to any consistency and mashes potatoes in record time with its heavy-duty construction. The bowl clamp lightens the load for hands-free operation while the wall-mount hanger provides an easy storage option.



WSB2W
10" Stainless Steel Whisk Attachment fits entire Big Stik® Heavy-Duty Immersion Blender line



WSB01
Wall-mount hanger available for easy storage while unit is not in use



WSBPP
Power pack fits entire Big Stik® Heavy-Duty Immersion Blender line

WSB Series Big Stik® Heavy Duty Shafts
Stainless steel shafts are interchangeable with the WSBPP Power Pack



WSBBC
Bowl clamp for hands-free operation



WARING® COMMERCIAL IMMERSION BLENDERS

WARING COMMERCIAL

Heavy-Duty Big Stix®

Immersion Blenders, Whisk Attachment and Accessories





The Big Stix®

WSB50
12" Immersion Blender

WSB55
14" Immersion Blender

WSB60
16" Immersion Blender

WSB65
18" Immersion Blender

WSB70
21" Immersion Blender

WSBPPW
10" Stainless Steel Whisk

WARING COMMERCIAL

Heavy-Duty Big Stix® and Accessories

Specifications

Item	Electrical	Watts	Listings	Max RPM	Dimensions (H" x W" x D")	Warranty
WSB50	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	27" x 5" x 5.5"	Limited 1 Year
WSB55	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	29" x 5" x 5.5"	Limited 1 Year
WSB60	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	31" x 5" x 5.5"	Limited 1 Year
WSB65	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	33" x 5" x 5.5"	Limited 1 Year
WSB70	120 Volt, 6.25 Amps, 50/60 Hz	750	ETL, NSF	18,000	36" x 5" x 5.5"	Limited 1 Year
WSBPPW	120 Volt, 6.25 amps, 50/60 Hz	750	ETL, NSF	1,600	31" x 5" x 5.5"	Limited 1 Year

Ordering Information

Description	Catalog #	Std Pkg.	Ship Wt. (Lbs.)	Cubic Feet	UPC Code
12" Big Stik® Immersion Blender	WSB50	2	9.5	1.70	040072002137
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18" Big Stik® Immersion Blender	WSB65	2	10.25	2.30	040072002878
21" Big Stik® Immersion Blender	WSB70	2	10.38	2.60	040072002885
12" Stainless Steel Shaft	WSB50ST	6	2.5	1.59	040072002540
14" Stainless Steel Shaft	WSB55ST	6	2.75	1.96	040072002557
16" Stainless Steel Shaft	WSB60ST	6	3.0	2.17	040072002564
18" Stainless Steel Shaft	WSB65ST	6	3.25	2.38	040072002922
21" Stainless Steel Shaft	WSB70ST	6	3.38	2.70	040072002939
10" Big Stik® Whisk	WSBPPW	2	22.0	2.94	040072008184
10" Whisk Attachment	WSB2W	4	18.2	1.20	040072009242
2 Stainless Steel Whipping Paddles	WSBWP	10	1.5	0.07	040072008504
Bowl Clamp	WSBBC	1	4.0	0.13	040072006937
Wall Mount Hanger	WSB01	64	32.1	1.66	040072002380
Big Stik® Power Pack	WSBPP	2	7.0	1.27	040072002649

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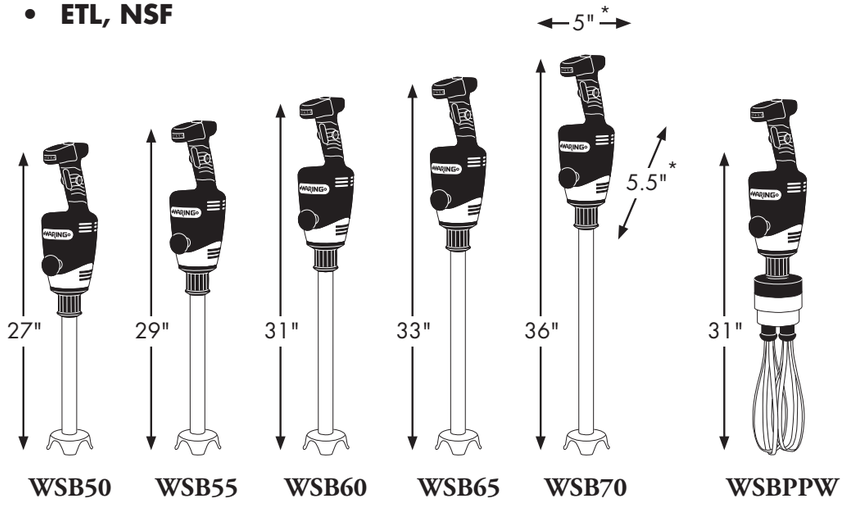
07WC30095
PG-21421

Big Stik® Heavy-Duty Immersion Blenders

The high-efficiency variable speed motor that powers Waring's Big Stik® Immersion Blenders drives through the thickest ingredients to produce sauces, batters and soups in just minutes. Complete with rubberized comfort grip and second handle (patent pending), the lightweight, ergonomic design allows for safe and controlled operation during any job, large or small. The easily removable stainless steel shafts are available in five sizes (up to 21") and are completely sealed and dishwasher safe. With the Big Stik® line, you can mix, purée and emulsify up to 50 gallons. Blend smoothly, and carry the Big Stik®.

Features

- **Heavy-Duty Motor** – High efficiency 1 HP motor, 750 watts, 18,000 RPMs processing speed on high
- **Variable Speed Motor** – Unlimited speed adjustment from 5,000 – 18,000 RPMs provides full control and consistency, from light mixing to puréeing and emulsifying
- **Lightweight and Ergonomic** – Rubberized comfort grip and second handle allow for safe and controlled operation
- **Completely Sealed Shafts** – Stainless steel shafts are easily removable and dishwasher safe
- **Continuous On Operation**
- **Versatility** – All five stainless steel shafts are interchangeable with one universal motor housing (Power pack – WSBPP)
- **Limited One Year Warranty**
- **ETL, NSF**



* 5" width and 5.5" depth are the same for all five immersion blenders and whisk

WARING® COMMERCIAL IMMERSION BLENDERS

Optional Accessories

Waring makes it easy to do more than just blend. The 10" Stainless Steel Whisk Attachment quickly transforms the Big Stik® into a gentle giant as it whips delicate egg whites, creams to any consistency and mashes potatoes in record time with its heavy-duty construction. The bowl clamp lightens the load for hands-free operation while the wall-mount hanger provides an easy storage option.



WSB2W
10" Stainless Steel Whisk Attachment fits entire Big Stik® Heavy-Duty Immersion Blender line



WSB01
Wall-mount hanger available for easy storage while unit is not in use



WSBPP
Power pack fits entire Big Stik® Heavy-Duty Immersion Blender line

WSB Series Big Stik® Heavy Duty Shafts
Stainless steel shafts are interchangeable with the WSBPP Power Pack



WSBBC
Bowl clamp for hands-free operation



"EPT6R5" Stainless Steel Prep Table w/ Sink

w/ 16 Gauge Stainless Steel Work Top
w/ Galvanized Base & Adjustable Undershelf



Item # _____ **Qty**____
Model # _____
Project _____

AUTOQUOTES

16 GAUGE TOP w/ ADJUSTABLE UNDERSHELF



30"WIDE	Qty
EPT6R5-3060GSK-L	
EPT6R5-3060GSK-R	
EPT6R5-3072GSK-L	
EPT6R5-3072GSK-R	

L = Left Bowl
R = Right Bowl

FEATURES:

* 16 Gauge Stainless Steel Top with 5" Riser & turndown
  Type 300 stainless steel with # 4 polish, satin finish
* 1 1/2" **Stallion Edge** on front with
  side edges 90 degree bend down for table line-up
* (1) 16"x 20"x12" Bowl
* Galvanized Base with **Adjustable** Undershelf
* Adjustable bullet feet
* Shipped knocked-down, easy - to - assemble
* NSF Approved

** Includes (1) Deck Mount Faucet 4" o/c w/ 10" Swing Spout

CONSTRUCTION:

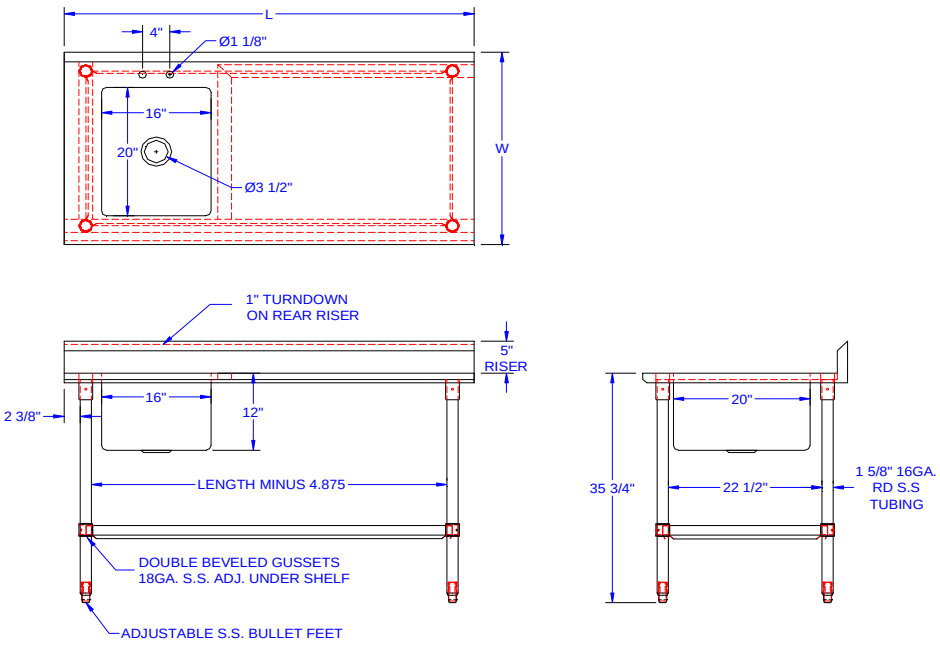
Top: Stainless Steel Tops are TIG welded, Exposed welds are polished to match adjacent surface.

MATERIAL:

Top: 16 gauge stainless steel
Type 300 stainless steel with # 4 polish, satin finish
Shelf: 18 gauge galvanized
Legs: 1 5/8" Round O.D., 16 gauge tubular galvanized steel
Gussets: Stainless Steel
Feet: 1" adjustable bullet feet

John Boos & Co
3601 S. Banker Street - Effingham, IL 62401
Phone: 217-347-7701 - Fax: 217-347-7705
Email: sales@johnboos.com - Web-site: www. johnboos.com

DETAILED SPECIFICATIONS



All units ship unassembled for reduced shipping cost.
All dimensions are typical.
Tolerance +/- .500".

Finished size of undershelf.
Shelf length = length minus 4.875"
Shelf width = width minus 4.25"

16 GAUGE TOP & UNDERSHELF

L	30" WIDE	W
60	EPT6R5-3060GSK-L	171
60	EPT6R5-3060GSK-R	171
72	EPT6R5-3072GSK-L	202
72	EPT6R5-3072GSK-R	202

5 = Heigth of Riser w/ turndown
R = Riser Top Work Table
6 = 16. ga Work Surface
EPT = Ecomony Prep Table

Witdh
Length
GS = Galvanized Legs & Shelf
K = K.D. w/ Adjustable Shelf
Bowl Location

EPT6R5-3060GSK-L

John Boos & Co
3601 S. Banker Str - Effingham, IL 62401 Phone: 217-347-7701 - Fax: 217-347-7705
Email: sales@johnboos.com - Web-site: www.johnboos.com

July 2013

John Boos is constantly engaged in a program of improving products and therefore reserves the right to change specification without prior notice

APPLICATION:

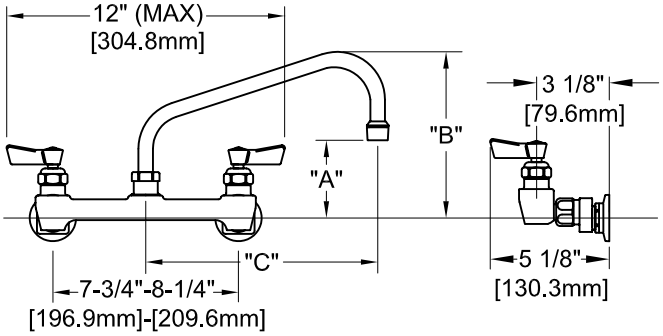
PRODUCT NAME:
8" ADJUSTABLE WALL MOUNT FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

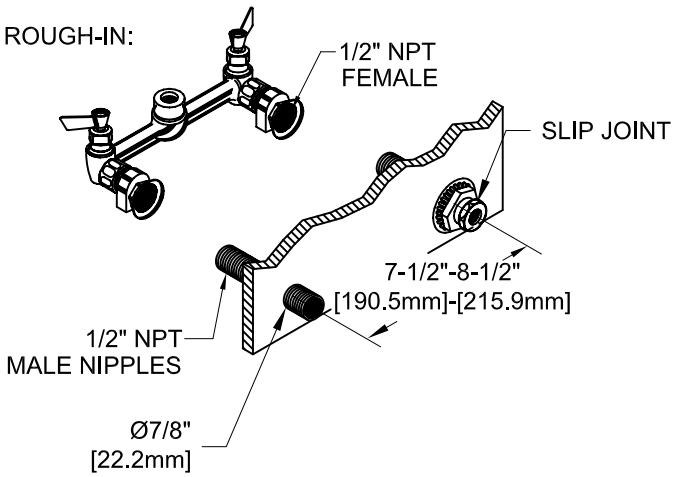
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:
- ☐ 3250 W/ 6" SWING SPOUT
- ☐ 3251 W/ 8" SWING SPOUT
- ☐ 3252 W/ 10" SWING SPOUT
- ☐ 3253 W/ 12" SWING SPOUT
- ☐ 3254 W/ 14" SWING SPOUT
- ☐ 9102 W/ 16" SWING SPOUT



MODEL	DIM "A"	DIM "B"	DIM "C"
3250	2-1/4" [57.2mm]	5-7/8" [149.2mm]	6" [152.4mm]
3251	2-1/2" [63.5mm]	6-3/8" [161.9mm]	8" [203.2mm]
3252	3-1/8" [79.4mm]	6-7/8" [174.6mm]	10" [254.0mm]
3253	3-3/4" [95.3mm]	7-3/8" [187.3mm]	12" [304.8mm]
3254	4-3/8" [111.1mm]	8-1/4" [209.6mm]	14" [355.6mm]
9102	5" [127.0mm]	8-7/8" [225.4mm]	16" [406.4mm]

ROUGH-IN:



ANSI/A112.18.1M

OPTIONS OR MODIFICATIONS:
- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ DJ SUB-ASSY (7-1/4" OR 13") CIRCLE LENGTH
- ☐ NIPPLES
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____

FEATURES:

* 8" ADJUSTABLE WALL MOUNT
* ECCENTRICS ADJUST FROM 7-3/4" TO 8-1/4"
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 5.0 LBS

FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3250 REV. B

JOB NAME:

QUANTITY:

ITEM NO.:

SPEC. S24090

E.C.O. # 3887

DATE: 05/15/01

PRODUCT NAME:

TWIST WASTE VALVE

☐ _____ SPECIAL CONFIGURATION
(CHECK BASE MODEL AND OPTIONS)

MODEL:

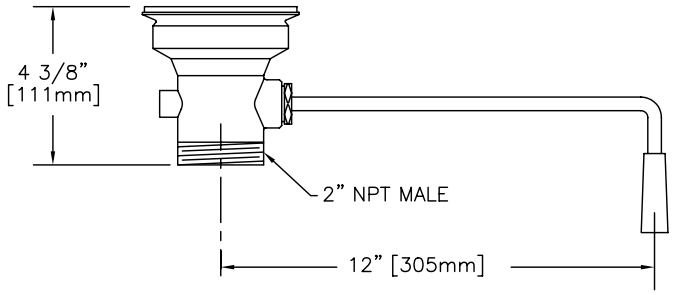
☐ 24090 WITH FLAT STRAINER

OPTIONS OR MODIFICATIONS:

☐ OTHER _____

FEATURES:

* 3 1/2" SINK OPENING
* 2" DRAIN OPENING
* CAST BRONZE BODY AND WORKING PARTS
* CHROME PLATED BODY AND WORKING PARTS
* FLAT STRAINER
* CSA CERTIFIED



DRAIN RATE:

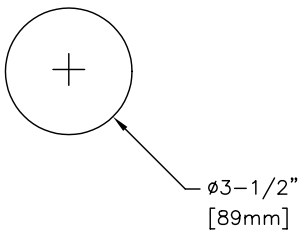
* 12 GPM

SHIPPING WEIGHT

* 3.3 LBS

ROUGH-IN:

DRAIN:



ANSI/A112.18.1M

Division of Fisher Manufacturing Company
P.O. Box 60 Tulare, CA 93725-0060 1900 "O" Street Tulare, CA 93274-6850
Phone 1-800-421-6162 FAX 800-8-FAUCET (800-832-8238)

15

SPEC SHEET

"EWS8" WALL SHELVES

Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
- 1-1/2" Turned Up Backsplash
- 12" Or 16" Depth
- Shipped Knocked-Down, Easy-To-Assemble
- All Models Are NSF Certified

SPECIFICATIONS:

- Stainless Steel Shelves Are TIG Welded
- Exposed Welds Are Polished To Match Adjacent Surface
- Shelf: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish
- Brackets: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish

CERTIFICATIONS:



EWS8-1636

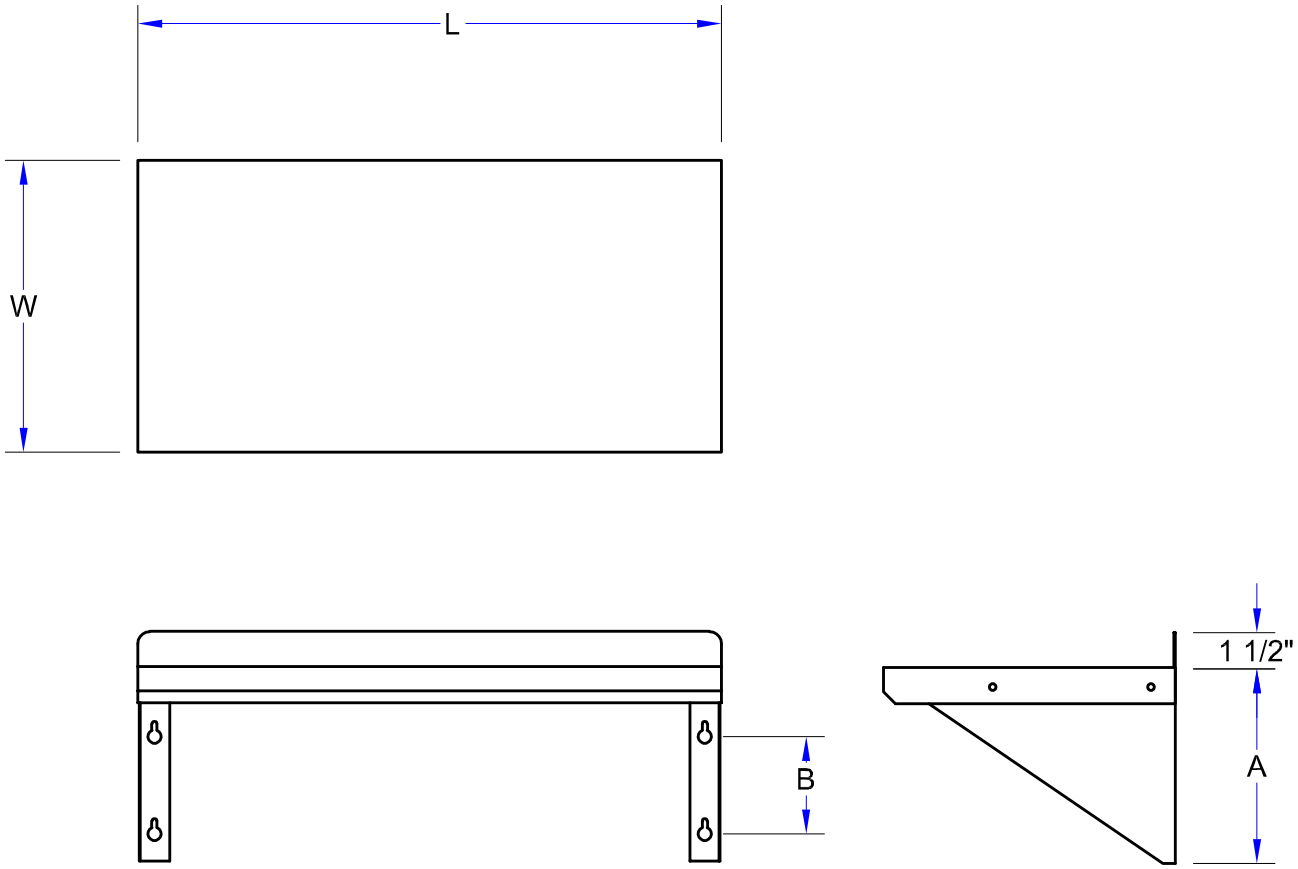
"EWS8" WALL SHELVES - STAINLESS STEEL

LENGTH	12" WIDE	A	B	WT (LBS)	16" WIDTH	A	B	WT (LBS)
24"	**EWS8-1224**	8"	4"	8	**EWS8-1624**	11-1/2"	7-1/2"	10
36"	**EWS8-1236**	8"	4"	12	**EWS8-1636**	11-1/2"	7-1/2"	14
48"	**EWS8-1248**	8"	4"	16	**EWS8-1648**	11-1/2"	7-1/2"	18
60"	**EWS8-1260**	8"	4"	21	**EWS8-1660**	11-1/2"	7-1/2"	24
72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
84"	**EWS8-1284** *	8"	4"	29	**EWS8-1684** *	11-1/2"	7-1/2"	35
96"	**EWS8-1296** *	8"	4"	33	**EWS8-1696** *	11-1/2"	7-1/2"	38

***NOTE: UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS**

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

DETAILED SPECIFICATIONS



"EWS8" WALL SHELVES - STAINLESS STEEL

LENGTH	12" WIDE	A	B	WT (LBS)	16" WIDTH	A	B	WT (LBS)
24"	**EWS8-1224**	8"	4"	8	**EWS8-1624**	11-1/2"	7-1/2"	10
36"	**EWS8-1236**	8"	4"	12	**EWS8-1636**	11-1/2"	7-1/2"	14
48"	**EWS8-1248**	8"	4"	16	**EWS8-1648**	11-1/2"	7-1/2"	18
60"	**EWS8-1260**	8"	4"	21	**EWS8-1660**	11-1/2"	7-1/2"	24
72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
84"	**EWS8-1284** *	8"	4"	29	**EWS8-1684** *	11-1/2"	7-1/2"	35
96"	**EWS8-1296** *	8"	4"	33	**EWS8-1696** *	11-1/2"	7-1/2"	38

***NOTE: UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS**

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SPEC SHEET

"EWS8" WALL SHELVES

Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
- 1-1/2" Turned Up Backsplash
- 12" Or 16" Depth
- Shipped Knocked-Down, Easy-To-Assemble
- All Models Are NSF Certified

SPECIFICATIONS:

- Stainless Steel Shelves Are TIG Welded
- Exposed Welds Are Polished To Match Adjacent Surface
- Shelf: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish
- Brackets: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish



EWS8-1636

CERTIFICATIONS:

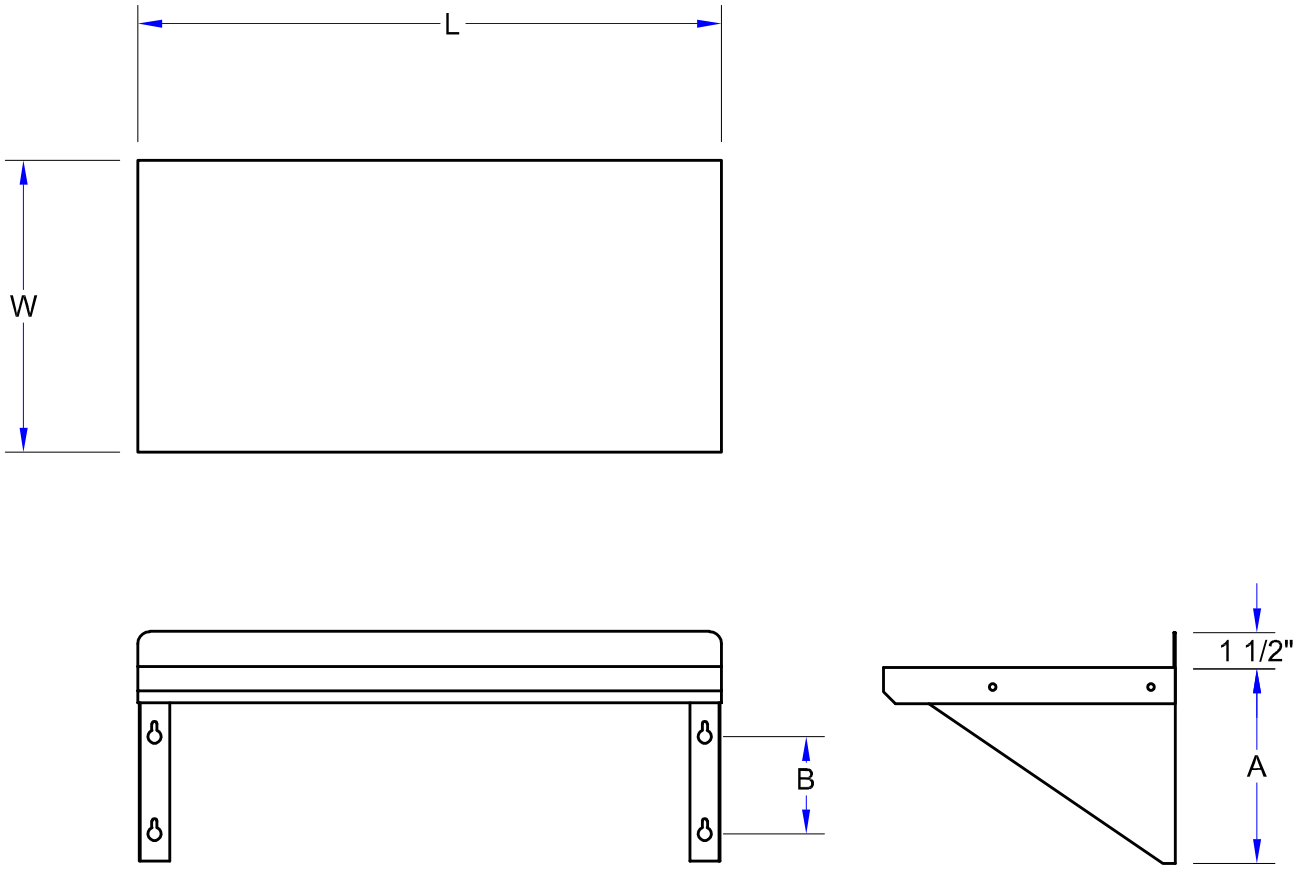
"EWS8" WALL SHELVES - STAINLESS STEEL

LENGTH	12" WIDE	A	B	WT (LBS)	16" WIDTH	A	B	WT (LBS)
24"	**EWS8-1224**	8"	4"	8	**EWS8-1624**	11-1/2"	7-1/2"	10
36"	**EWS8-1236**	8"	4"	12	**EWS8-1636**	11-1/2"	7-1/2"	14
48"	**EWS8-1248**	8"	4"	16	**EWS8-1648**	11-1/2"	7-1/2"	18
60"	**EWS8-1260**	8"	4"	21	**EWS8-1660**	11-1/2"	7-1/2"	24
72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
84"	**EWS8-1284** *	8"	4"	29	**EWS8-1684** *	11-1/2"	7-1/2"	35
96"	**EWS8-1296** *	8"	4"	33	**EWS8-1696** *	11-1/2"	7-1/2"	38

***NOTE: UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS**

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DETAILED SPECIFICATIONS



"EWS8" WALL SHELVES - STAINLESS STEEL

LENGTH	12" WIDE	A	B	WT (LBS)	16" WIDTH	A	B	WT (LBS)
24"	**EWS8-1224**	8"	4"	8	**EWS8-1624**	11-1/2"	7-1/2"	10
36"	**EWS8-1236**	8"	4"	12	**EWS8-1636**	11-1/2"	7-1/2"	14
48"	**EWS8-1248**	8"	4"	16	**EWS8-1648**	11-1/2"	7-1/2"	18
60"	**EWS8-1260**	8"	4"	21	**EWS8-1660**	11-1/2"	7-1/2"	24
72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
84"	**EWS8-1284** *	8"	4"	29	**EWS8-1684** *	11-1/2"	7-1/2"	35
96"	**EWS8-1296** *	8"	4"	33	**EWS8-1696** *	11-1/2"	7-1/2"	38

***NOTE: UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS**

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

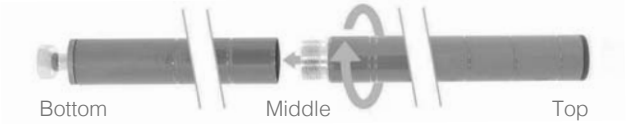
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

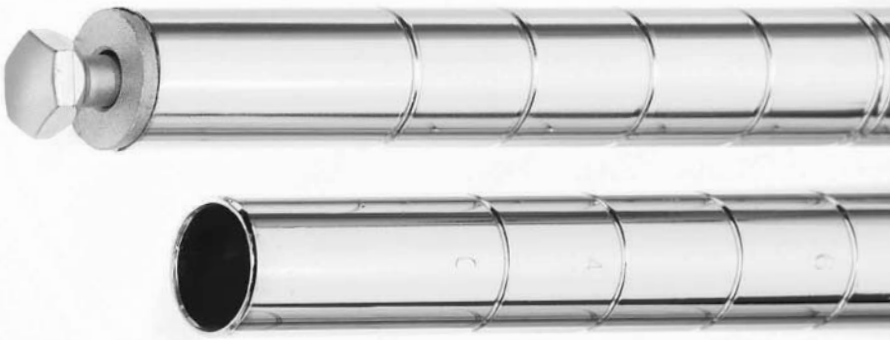
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

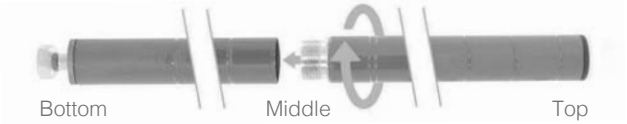
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

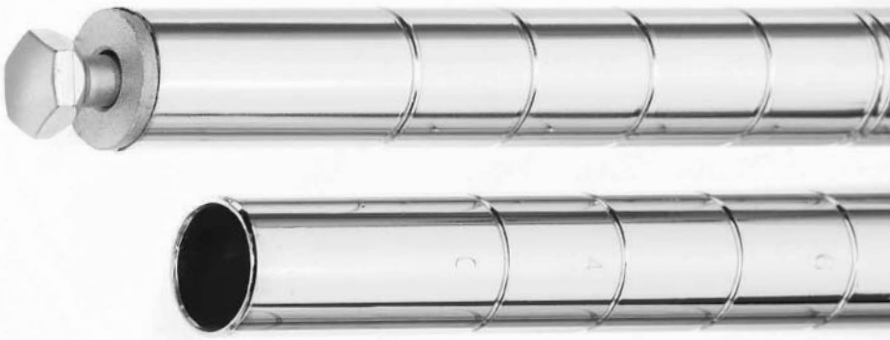
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

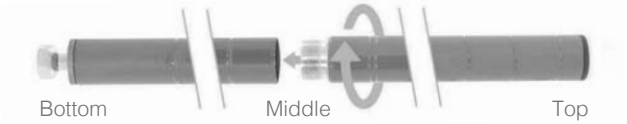
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

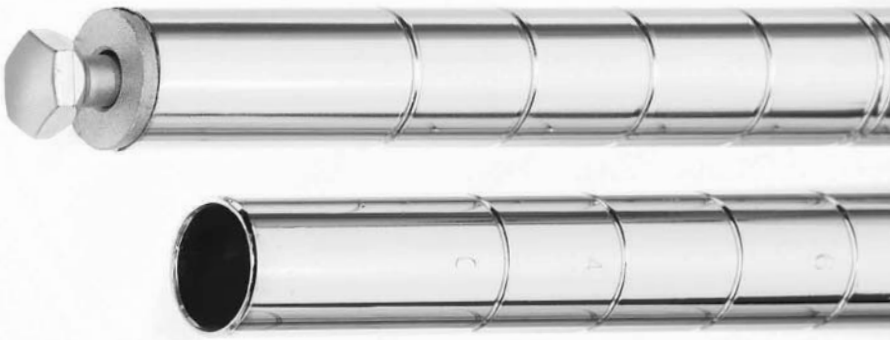
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

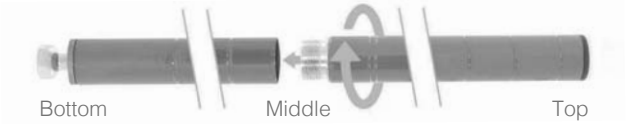
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

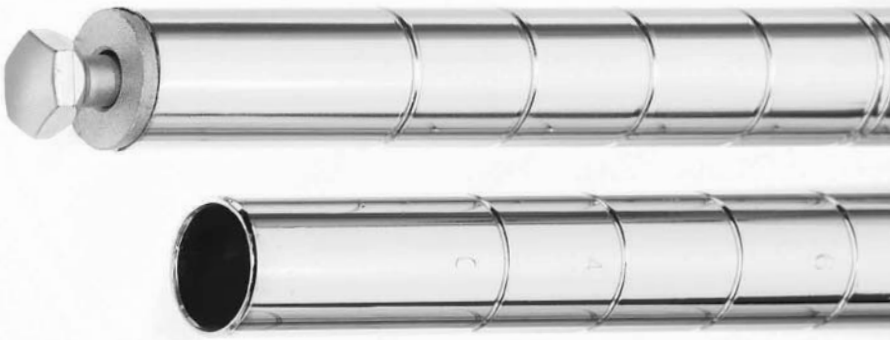
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

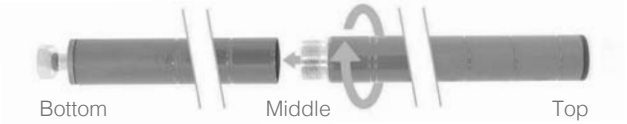
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

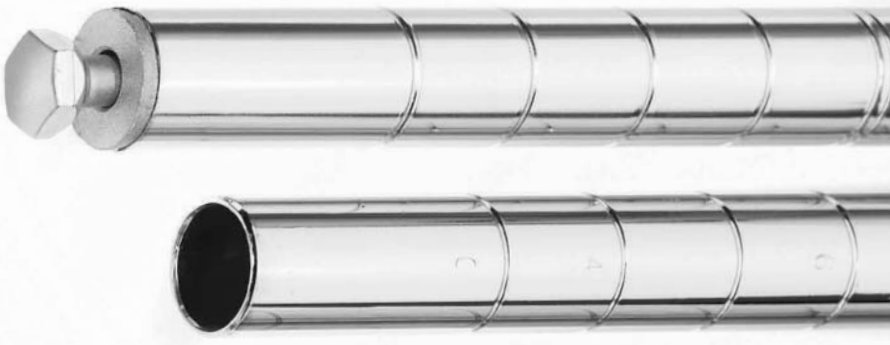
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
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See Casters on Next Page ▸

ADVANCE TABCO
SMART FABRICATION™

HEAVY DUTY PORTABLE BARS WITH DOORS

w/ ALL STAINLESS STEEL BARTENDER SIDE

Designed For **HEAVY DUTY** Use

Item #:_____ Qty #:_____
Model #:_____
Project #:_____



FEATURES:

All stainless steel bartender side.

19" x 13-1/2" x 11" stainless steel insulated integral ice bin with cover. Complete with drain & shut-off valve.

Stainless steel speed rails.

Center stainless steel panel for extra support.

Hinged door with lock on left and right side of center support panel.

Full perimeter bumpers.

Four 5" heavy duty swivel casters (2 with brakes).

Bottom shelf for glass rack storage.

-7 Models Includes above features with additional 7-circuit post mix cold plate in right ice bin.

MATERIAL:

Top & Front: Mica laminate, black finish
Unit: Stainless steel work top, back, sides & bottom
Bartender Side: Stainless steel
Casters: Rubber
Speed Rails: Stainless steel

Standard Model #	Wt.	Cold Plate Model #	Wt.	Size L x W x H	Storage Cabinet Dim. L x W x H	# Of Speed Rails	Bottle Capacity Per Speed Rail (750ml Bottles)	Ice Capacity	Bar Top Width	Cu. Ft.
AMD-5B	423	AMD-5B-7	448	62 1/4" x 28 1/8" x 46 5/8"	57 7/8" x 23 3/4" x 15 1/2"	2	10	50 lbs.	12"	50
AMD-6B	464	AMD-6B-7	489	74 3/8" x 28 1/8" x 46 5/8"	69 7/8" x 23 3/4" x 15 1/2"	3	15	50 lbs.	12"	60

CUSTOM EXTERIOR OPTIONS

Applied To Portable Bar Front And Sides ONLY, Unless Otherwise Specified



-LMP
Marula Pine Laminate



-LCW
Columbian Walnut Laminate



-LCM
Calcutta Marble Laminate



-SS
Stainless Steel Panels
(Includes Bar Top)



SU-81
Custom Laminate Of Your Choice
Consult Factory For Pricing & Details

Add Model Number At End Of Portable Bar Model Number When Ordering (Example: R-8-B-LCW)

ADVANCE TABCO
SMART FABRICATION™
www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

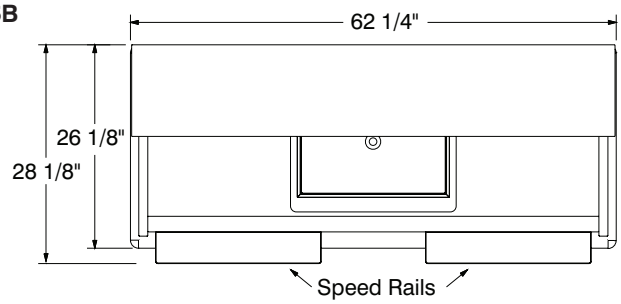
For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

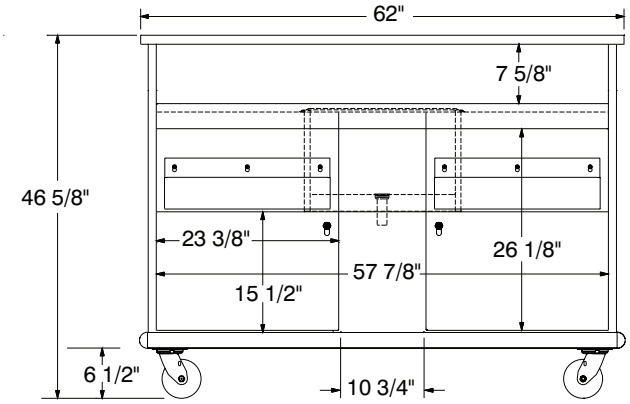
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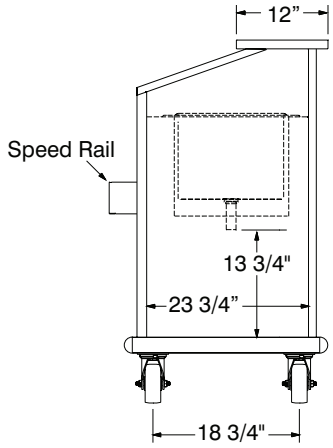
DIMENSIONS and SPECIFICATIONS

TOL ± .125” ALL DIMENSIONS ARE TYPICAL

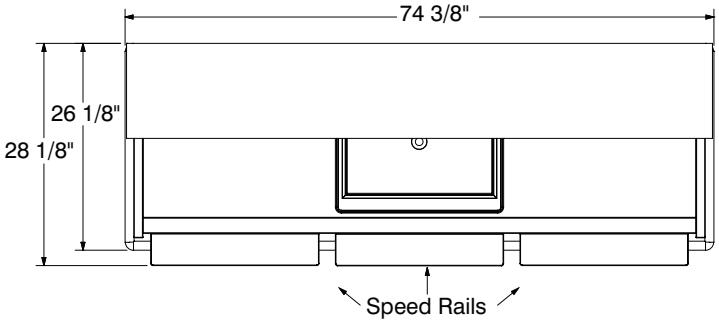
AMD-5B

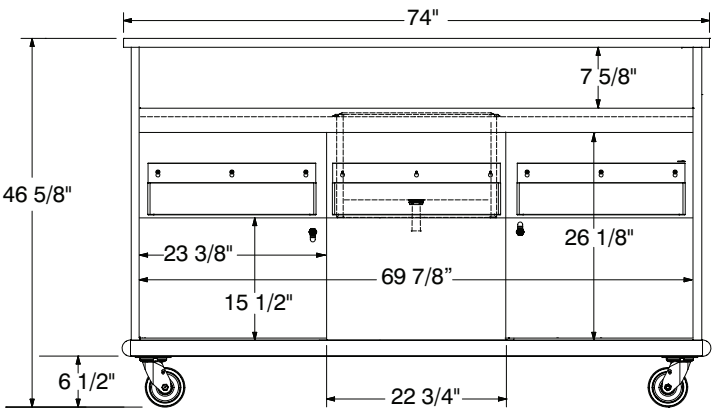


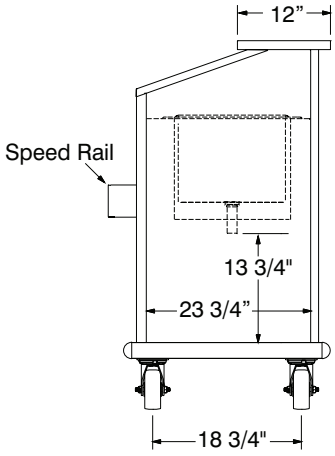




AMD-6B







ADVANCE TABCO
SMART FABRICATION™

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

© ADVANCE TABCO, AUGUST 2020

KM-1100M_J(Z)

MODULAR CRESCENT CUBER

KM-1100M_J(Z)
10/24/22
Item # 13218

Item #: _____

Project: _____

Qty: _____

AIA#: _____

W x D x H
30" x 27 3/8" x 32 1/2"



KM Edge DESIGN

KM-1100MAJ
Air-Cooled
Shown on optional bin B-500

KM-1100MWJ
Water-Cooled

KM-1100MRJZ
Remote Air-Cooled

Features

- **Individual crescent cube**
- **Stainless steel evaporator**
- **CycleSaver™ design**

- Up to 1156 lbs. of ice production per 24 hours
- Mount two units, side-by-side, for 2,312 lbs. per 24 hours (in only 60" of floor space)
- Durable stainless steel exterior
- Protected by H-Guard Plus Antimicrobial Agent
- EverCheck™ alert system
- Removable air filters (Air-cooled model only)
- R-404A Refrigerant

Available on Bins:

B-500SF	B-800SF	B-1150SS	B-1500SS*
B-700SF	B-900SF	B-1300SS	B-1650SS*

*Top kit may be required. See Bin Spec Sheets. *Two unit application only.*

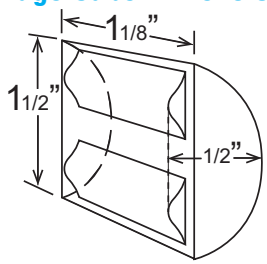
Warranty:
3 Year Parts & Labor on entire machine. 5 Year Parts & Labor on Evaporator.
5 Year Parts on Compressor; air-cooled condenser coil.
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

Shipping: (LxWxH) 33.75" x 33.25" X 38" Volume: 24.82ft³

		ICE PRODUCTION		WATER USAGE		ELECTRICAL							
Condenser	Model	Air / Water Temp Lbs. per 24 hours 70°/ 50°F	90°/ 70°F	Potable Gal. per 100 lbs. 90°/ 70°F	Condenser Gal. per 100 lbs. 90°/ 70°F	kWh Used per 100 lbs. 90°/ 70°F	Max. Fuse Sz or HACR Circuit Bkr	Amperage	Voltage	Circuit Wires (including ground)	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
Air	KM-1100MAJ	1087	935	19.0	N/A	4.9	20A	12.5A	208-230/60/1	3	15,700	3 lbs. 1.4 oz.	260 / 290
Water	KM-1100MWJ	1073	1006	20.0	107	4.0	20A	9.6A	208-230/60/1	3	17,100	1 lb. 10.5 oz.	250 / 280
Remote	KM-1100MRJZ	1156	1030	18.0	N/A	4.5	20A	12.5A	208-230/60/1	3	15,600	5 lb. 4.7 oz. 9 lb. 11.2 oz.†	242 / 272

† (with condenser)

KM Edge Cube Dimensions*



* approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 187-253V

Service

- Panels easily removed and all components accessible for service.
- Allow 12" (30 cm) clearance at rear, sides, and top for proper air circulation and ease of maintenance/service.

Plumbing

- Icemaker Water Supply Line: Min. 3/8" Nominal ID Copper Water Tubing or Equivalent
- Icemaker Drain Line: Min. 3/4" Nominal ID Hard Pipe or Equivalent

Water-Cooled Model (Lines Must Be Independent of Icemaker)

- Condenser Water Supply Line: Min. 3/8" Nominal ID Copper Water Tubing or Equivalent
- Condenser Drain/Return Line: Min. 3/8" Nominal ID Hard Pipe (open drain system) or Copper Water Tubing (closed loop system) or Equivalent

Water Filter

Please refer to water filter spec sheet for recommended configurations.

Hoshizaki reserves the right to change specifications without notice.

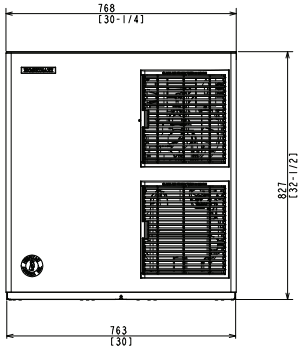
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KM-1100M_J(Z)

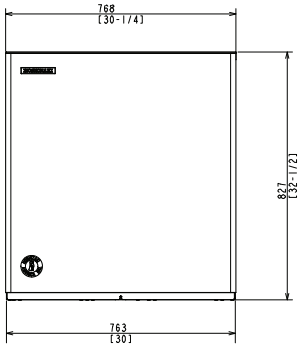
MODULAR CRESCENT CUBER

KM-1100M_J(Z)
10/24/22
Item # 13218

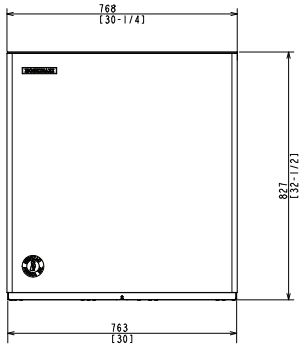
FRONT VIEW



AIR-COOLED

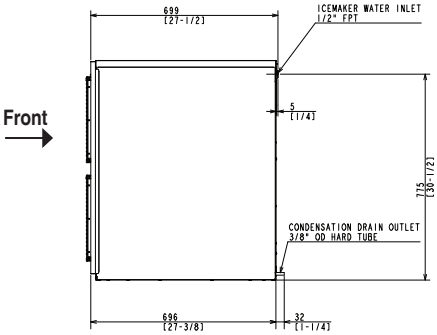


WATER-COOLED

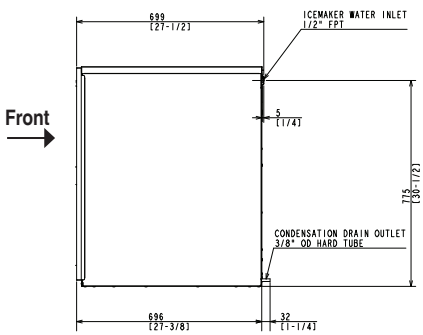


REMOTE AIR-COOLED

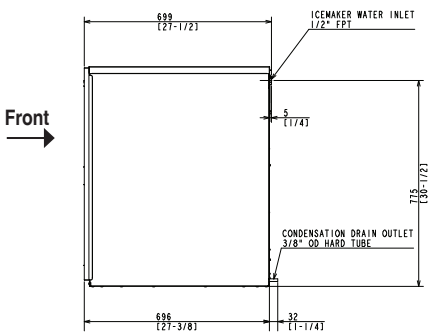
SIDE VIEW



AIR-COOLED

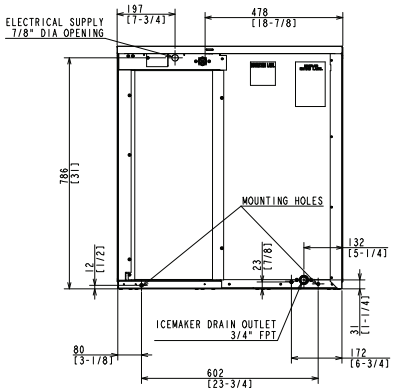


WATER-COOLED

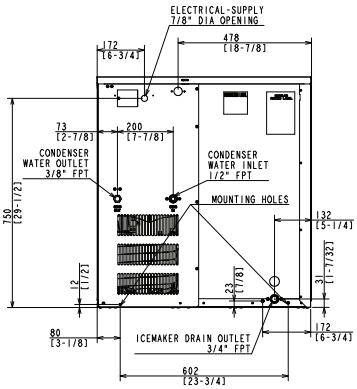


REMOTE AIR-COOLED

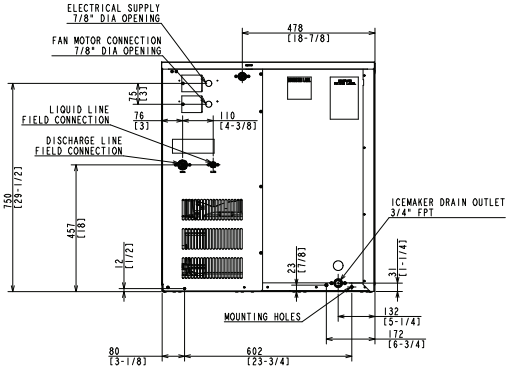
REAR VIEW



AIR-COOLED

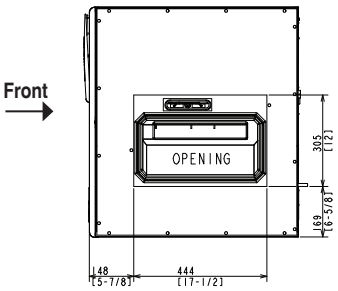


WATER-COOLED

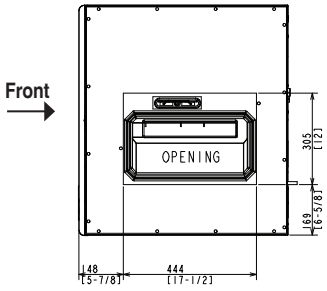


REMOTE AIR-COOLED

BOTTOM VIEW



AIR-COOLED

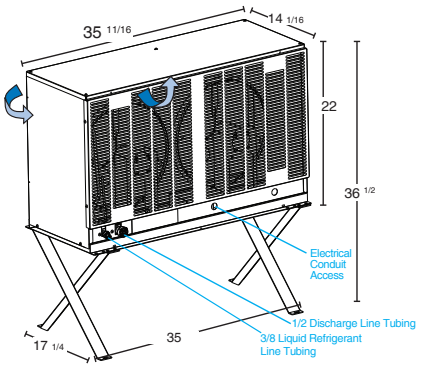


WATER-COOLED
REMOTE AIR-COOLED

Brazed Line Sets
(Sold Separately)
25' HS-5604
35' HS-5605
55' HS-5606

Voltage supply for the URC Remote Condenser is supplied from the Ice Maker. No addtional circuit is required.

URC-14FZ Remote Condenser (Sold Separately)
(W x D x H) 35 11/16 x 14 1/16 x 36 1/2
For Use with KM-1100MRJZ



SF Bins

ICE STORAGE BIN SERIES

Item #: _____

Project: _____

Qty: _____

AIA#: _____

SF - Stainless Steel Finish



B-250SF | B-300SF BD-300SF | B-500SF BD-500SF



B-700SF | B-800SF | B-900SF

Features

- **Protected by H-GUARD Plus Antimicrobial Agent**
- **Polyethylene bin liner for sanitary storage**
- **Sturdy construction for side-by-side or stacked ice machine installation**

- Ice storage capacity from 250 lbs. up to 900 lbs.
- Both surfaces are designed for easy cleaning
- Long lasting attractive appearance
- Foamed-in-place polyurethane insulation, in all bin walls and bottom, provides dependable ice storage
- H-GUARD Plus Antimicrobial adds extra protection to the ice scoop (included)

SF - Stainless Steel Finish

BD Bins

- Fit 24" - 24 1/2" deep ice machine without top kit extension

Warranty:

2 Year Parts & Labor (Production prior to January 2012)
3 Year Parts & Labor (Production January 2012 and after)
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

Model Number	Exterior Dimensions W x D x H*	Interior Dimensions W x D x H	Application Storage Capacity†	Cubic Volume	Shipping Dimensions L x W x H	Shipping Weight (lbs.)
B-250SF	30" x 32.3" x 33.4"	27" x 27.7" x 23.7"	250 lbs.	10.30 ft³	35" x 32" x 32"	—
B-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	125
BD-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	130
B-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
BD-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
B-700SF	44" x 32.3" x 46"	41" x 27.7" x 37.6"	700 lbs.	24.77 ft³	46" x 35" x 45"	175
B-800SF	48" x 32.3" x 46"	45" x 27.7" x 37.6"	800 lbs.	26.90 ft³	50.25" x 35" x 45"	185
B-900SF	52" x 32.3" x 46"	49" x 27.7" x 37.6"	900 lbs.	29.59 ft³	54.5" x 35" x 45"	195

*Height includes 6" legs
† Capacity based on volume x 30 lb/ft³ average density of ice.

Hoshizaki reserves the right to change specifications without notice.

SF Bins

ICE STORAGE BIN SERIES

Ice Machine Model Application

	22" Width KM-350M KM-520M KM-660M F-450M F-801M F-1002M	22" Width KMD-410M† KMS-822M FD-650M-C† FD-1002M-C	30" Width KM-901M KM-1340M KM-1601M KML Series F-1501M F-2001	30" Width KMD-460M‡ KMD-530M‡ KMD-860M‡ KMS-1402M* KMS-2000M*	44" Width 2 KM-350M 2 KM-520M 2 KM-660M IM-500S 2 F-450M 2 F-801M 2 F-1002M	44" Width 2 KMD-410M 2 FD-650M-C 2 FD-1002M-C	48" Width KM-1301S KM-1400S KM-1601S KM-1900S KM-2200S KM-2600S
Bins B-300SF DB-130H	– *(DB-130H - KMD only)*	NEED HS-5424 HS-2153 *(KMD-410 on B-300 only)*	N/A	N/A	N/A	N/A	N/A
Bins B-250SF B-500SF	NEED HS-2033	NEED HS-2033 & HS-2129	–	NEED HS-2129	N/A	N/A	N/A
Bins B-700SF	NEED HS-2035	NEED HS-2035 & HS-2130	NEED HS-2034	NEED HS-2130 & HS-2034	–	NEED HS-2130 *(KMD-410 does not apply)*	N/A
Bins B-800SF	NEED HS-2035 & HS-2032	NEED HS-2035, HS-2032 & HS-2131	NEED HS-2034 & HS-2032	NEED HS-2131, HS-2034 & 2032	NEED HS-2032	NEED HS-2032 & HS-2131	–
Bins B-900SF	NEED HS-2035 & HS-2033	NEED HS-2035, HS-2033 & HS-2132	NEED HS-2035	NEED HS-2132 & HS-2035	NEED HS-2033	NEED HS-2033 & HS-2132	NEED HS-2032
Bins DB-200H DM-200B	NEED HS-2036 *(KM units only)*	N/A	– *(KML only)*	N/A	N/A	N/A	N/A

– No top kit necesary | N/A Combination of ice maker and bin is not possible

BD Bins fit 24" - 24 1/2" deep ice machine without Top Kit extension.

† **BD-300SF:** KMD-410M, KMS-822M, FD-650M-C, FD-1002M-C

‡ **BD-500SF:** KMD-460M, KMD-530, KMD-860

* Any KMS or FD on bin need Top Kit Extension:

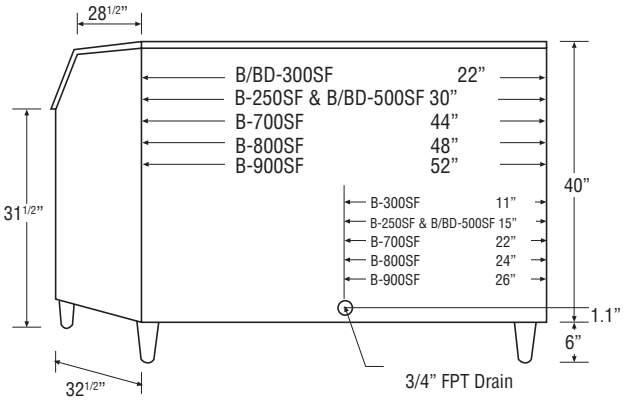
- HS-2129 - for use with B-500 bins
- HS-2130 - for use with B-700 bins
- HS-2131 - for use with B-800 bins
- HS-2132 - for use with B-900 bins

Top Kits:

HS-2032 - 4" ABS Top Kit
HS-2033 - 8" ABS Top Kit
HS-2034 - 14" ABS Top Kit
HS-2035 - 22" ABS Top Kit
HS-2036 - (2) 4" ABS Top Kits
HS-2066 - Seismic Kit for SD 500 Stands
HS-2071 - Anchored Leg Kit SD 500 Stands
HS-2111 - 11.3" x 26.2" Stainless Cover/Separator
HS-2148 - 30" x 3.1" Stainless Cover
HS-2153 - KMD-410 on B-300 bin
HS-2160 - 2 KM-901M

B-250SF





Ice Drop Area



B Bins



BD Bins



Bin Flanged Legs:
B/BD-300SF



Bin Legs:
B-250SF, B/BD-500SF
B-700SF, B-800SF
B-900SF

WATER FILTERS

FILTRATION SYSTEMS

WATER FILTERS
06/26/20
Item # 13076

Item #: _____

Project: _____

Qty: _____

AIA#: _____

H9320 FILTER
Single, Double, Triple



H9320-51

Single Configuration
18.4" H*



H9320-52

Double Configuration
19.11" H*



H9320-53

Triple Configuration
19.15" H*

*height includes manifold and cartridge

HOSHIZAKI H9320 FILTER

Available in single, double and triple configurations. Rated NSF Class 1, STD 42, for taste, odor and chlorine reduction and for mechanical filtration (95.6% removal of particles one (1) micron and larger in size.)

- Keep ice makers functioning at full capacity
- 93.7% average reduction of chlorine from incoming water supply, eliminating tastes and odors of the ice
- Filters are rated as one (1) micron nominal producing crystal clear ice
- Decrease machine maintenance by reducing lime scale build-up

Model	Filter	Max Flow Rate	Working Pressure	Temperature	Capacity
H9320-51	4HC-H	2 gpm	10-125 psi	35-100°F	21,000 gal
H9320-52	4HC-H	4 gpm	10-125 psi	35-100°F	42,000 gal
H9320-53	4HC-H	6 gpm	10-125 psi	35-100°F	63,000 gal

Plumbing

Inlet/Outlet Connections: Single: (2) 3/8" FNPT
Double & Triple: (1) 3/4" MNPT / (1) 3/4" FNPT

The H9320 Filters and their respective cartridges have been tested and listed by NSF only for the functions listed above. Check for compliance with state and local laws and regulations. Do not use where the water is microbiologically unsafe, or with waters of unknown quality without adequate disinfection before or after the unit. The H9320 filter can be used with water that may contain filterable cysts.

The H9320 System is tested and certified by NSF International against NSF/ANSI Standard 42 for the reduction of:

Std. No. 42 - Aesthetic effects

Aesthetic Effects
Bacteriostatic Effects
Chemical Reduction
Chlorine

Mechanical Filtration
Nominal Particulate Class 1
Taste & Odor

E-10 PREFILTER
(9795-80)

E-20 PREFILTER
(9795-90)



E-10 PREFILTER
(9795-80)
Recommended for single configuraton



E-20 PREFILTER
(9795-90)
Recommended for twin and triple configuraton

E-10 and E-20 Prefilters can be used for ice. Everpure prefilters are designed to increase the life of Hoshizaki 4HC-H water filters in areas with an unusual amount of dirt in the water. With a 10 micron (nominal) rating, the economical Everpure prefilter traps much of the dirt which contributes to scale buildup in ice makers, and clogs the delicate orifices of other water-using equiment.

When you install an Everpure prefilter, the Hoshizaki 4HC-H water filters can concentrate on what they do best: remove particles one (1) micron nominal and larger in size.

Replacement Cartridges:
E-10 Prefilters: 12 pack (9534-12)
40 pack (9534-40)

E-20 Prefilters: 6 pack (9534-26)
20 pack (9534-20)

Warranty:

One Year replaceable elements*
One Year the entire system
* Warranty applies to material defects in materials & workmanship only.

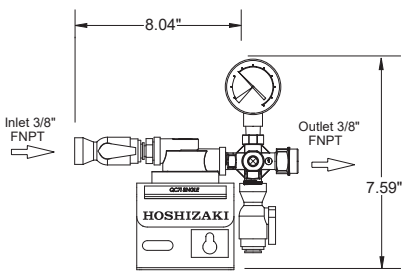
Hoshizaki reserves the right to change specifications without notice.

WATER FILTERS

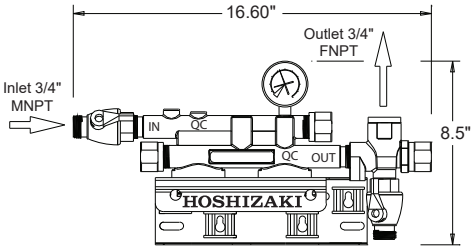
FILTRATION SYSTEMS

Model Number	Description Flow Rate (Gal. per min.)	Undercounter KMs	KM Cubers	IM Cubers	Cubelets & Flakers	DCM/DBs
H9320-51	Single (2 GPM)	AM-50 KM-81 KM-116 KM-161 KM-231 KM-301	KM-350, 520, 660 KML-325, 500, 700 KMD-410, 460, 530 KMS-830 DKM-500	IM-200, 500	All Models	All Models
H9320-52	Twin 2 x (2 GPM)	N/A	KM-901, 1100 KMD-860 KMS-822, 1122, 1402	IM-50BAA-Q	N/A	N/A
H9320-53	Triple 3 x (2 GPM)	N/A	KM-1301, 1340, 1601, 1900, 2200, 2600 KMH-2100 KMS-2000	N/A	N/A	N/A
H9655-11	Replacement Cartridge (1) One each	Recommended water filter configurations based on average ice machine usage and regular filter replacement. If your operation has challenging water conditions or higher usage, then it may be necessary to use an additional filter or prefilter.				

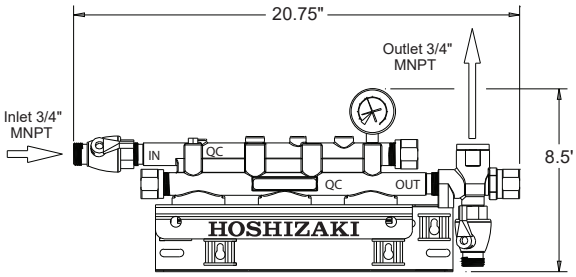
Single



Twin



Triple



SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

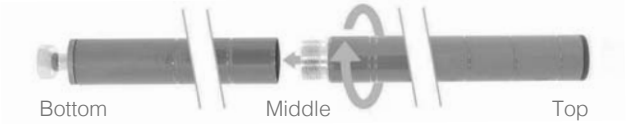
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

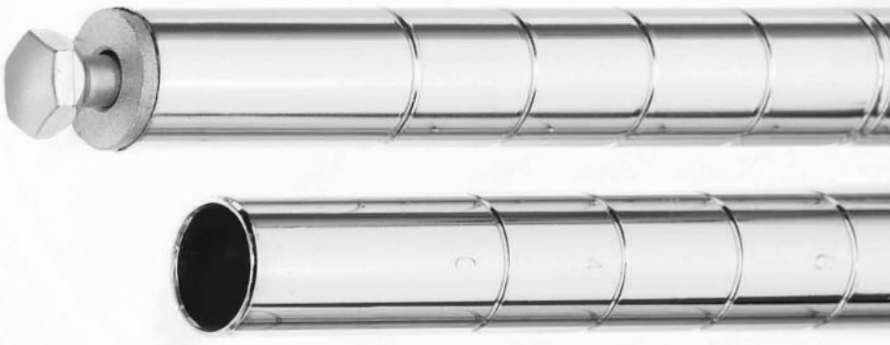
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

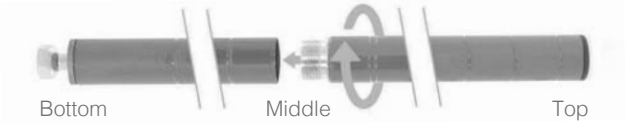
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

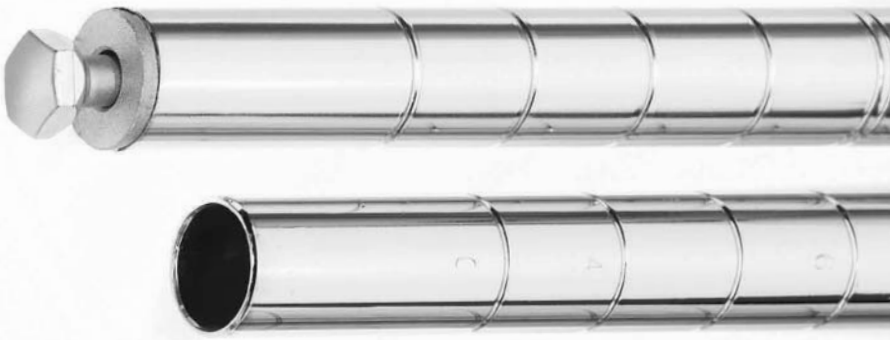
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

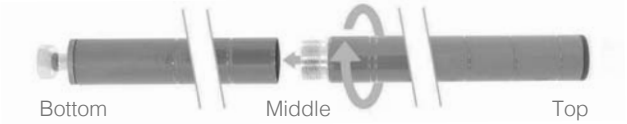
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

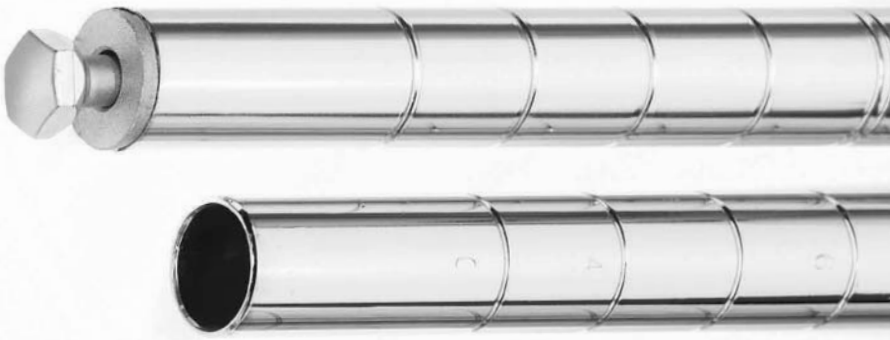
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



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See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

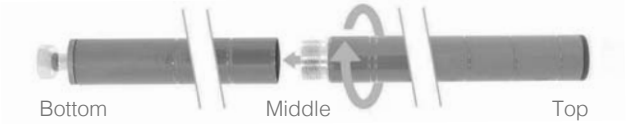
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

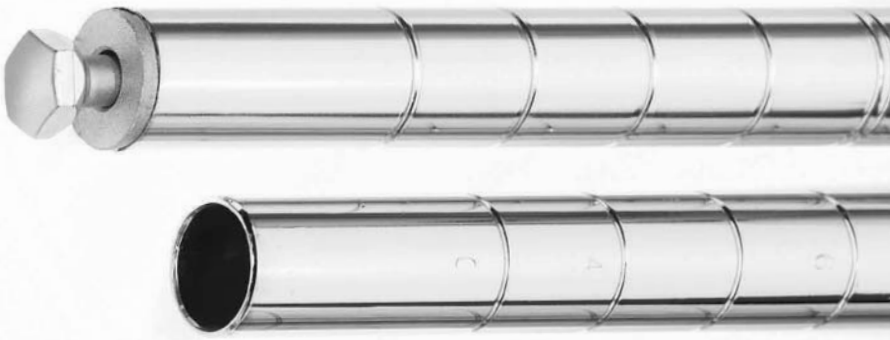
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
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See Casters on Next Page ▸

PT2A-FG-FG

Two Section Full Glass Door Pass Thru Refrigerator

STEELHEART

PT2A-FG-FG
12/12/19
Item # 13565

Item #: _____

Project: _____

Qty: _____

AIA#: _____

W x D x H
55” x 37.75” x 79.5”*
*with 4” casters



NATURAL REFRIGERANT

FACTORY WARRANTY *
Parts & Labor 3 YR Entire Machine
Parts 5 YR Compressor

Dimensions / Capacity	Two Section PT2A-FG-FG
Interior Storage Capacity (CF) (AHAM)	52.50 ft³
Overall Width x Depth	55” x 37.75”
Height (including 4” casters)	79.5”
Door Opening Width x Height	21.75” x 59.25”
Depth with Both Doors Open at 90° (front and back)	82.5”
Adjustable Shelves	6
Shelf Dimensions (W x D)	21.25” x 26”
Adjustable Center Shelves	3
Center Shelf Dimensions (WxD)	6” x 17.8”
Crated Shipping Weight	681 lbs
Crated Length x Depth x Height	58” x 41.25” x 81”

Electrical / Refrigeration	Two Section PT2A-FG-FG
Voltage	115/60/1
HACR Breaker	15.0 Amps
Electrical Connection (NEMA)	5-15P
Voltage Range	104-126
Ambient Temp. Range	45° to 100°F
Control Setpoint Range	31° to 52°F
Amperage	8
Energy Consumption (kWh/day) @ASHRAE	6
Heat Rejection (BTU/Hr.) @NSF	1429
Approx. Nominal Compres. BTU/HR (HP)	1545 (1/2HP)
Refrigerant / Charge Amount (oz)	R290 / (5.3 oz)

Options

- ☐ Additional epoxy shelves
- ☐ Stainless steel shelves
- ☐ Tray/Pan slides
- ☐ Additional air filter
- ☐ Foot pedal

Warranty

* 3 Year - parts and Labor on entire machine.
5 Year - Parts on Compressor
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

Features

- **Maximum interior storage capacity with smallest external footprint**
- **Stainless steel interior with stainless steel exterior front, sides and top**
- **Unique ducted air distribution system**
- (2x) Energy efficient interior LED lights
- Environmentally friendly R290 hydrocarbon refrigerant
- Solid state digital controller with temperature alarms and LED display (Fahrenheit or Celsius)
- Cabinet is insulated with 2-3/8” of CFC free,foamed in place polyurethane
- Glass doors are energy efficient multi-pane, argon filled with locks
- Exclusive stepped door design to protect recessed door gasket
- Spring assisted self-closing doors with stay open feature
- Sturdy 8 gauge stainless steel hinge plate with welded hinge pin
- Extruded aluminum flush mount door handle
- Field reversible doors
- Evaporator coils are epoxy electrocoated (E-Coat) to help fight corrosion
- Energy efficient automatic hot gas condensate evaporator
- Top mount refrigeration comes standard with a condenser filter
- Refrigerant flow is controlled with thermostatic expansion valve
- Stainless steel shelf supports
- (3) epoxy coated wire shelves are standard
- Standard with 4” casters (two with brakes)
- Stackable (two units high) to conserve warehouse floor space
- 10 ft. cord and plug

Note: Made to order. Allow 4-6 weeks.

Hoshizaki reserves the right to change specifications without notice.

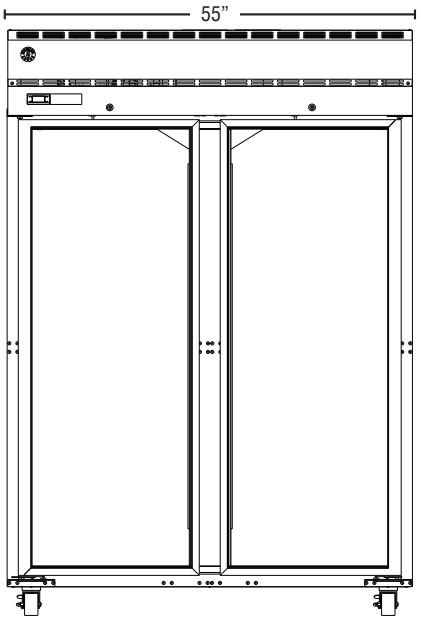
PT2A-FG-FG

Two Section Full Glass Door Pass Thru Refrigerator

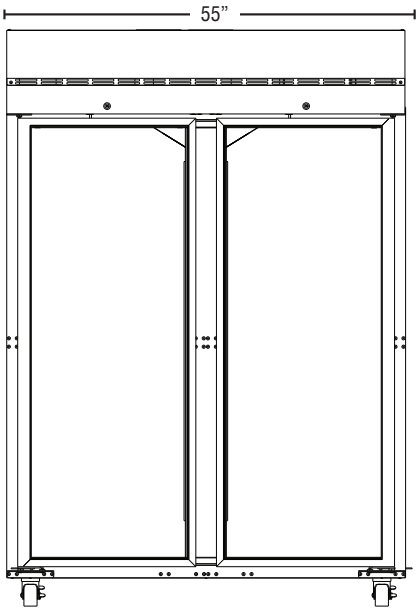
STEELHEART

PT2A-FG-FG
12/12/19
Item # 13565

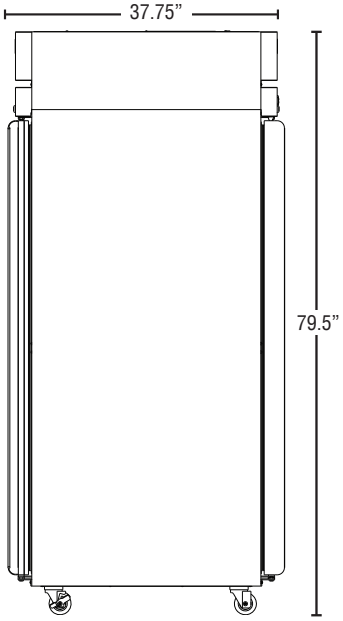
FRONT VIEW



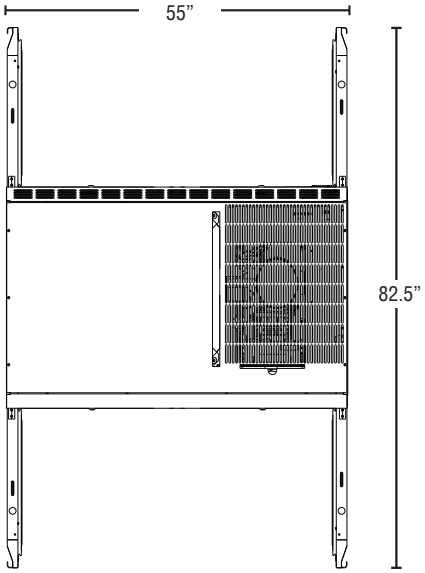
BACK VIEW



SIDE VIEW



PLAN VIEW



Cabinet Construction

The exterior cabinet front, sides, and top are constructed of high quality stainless steel. The cabinet interior is constructed of stainless steel with a unique ducted air flow system. Three (3) heavy duty epoxy coated shelves per section are standard. Mounted on stainless steel pilasters shelves are adjustable in 1” increments. Cabinet walls are insulated with 2-3/8” of environmentally friendly, CFC free, foamed in place polyurethane. (2x) interior LED lights provide energy efficient illumination. 4” polyolefin, casters (two with brakes) are standard.

Door Construction

Glass doors are constructed of high grade silver anodized aluminum with a full length chrome handle. Door glass is energy efficient multi pane, argon filled with locks. The door hinges are all metal and include an adjustable torsion spring closure that will not wear out like traditional cam-lift hinges. Hinge plates are constructed of heavy duty stainless steel. Doors stay open at 90° and are self-closing at 75°. Snap-in magnetic door gaskets are durable and easily removed for cleaning. Door hinging is field reversible.

Refrigeration System

The high efficiency refrigeration system is self-contained with an epoxy electrocoated (E-Coat) evaporator for extended life. Top mounted refrigeration system is easily accessible for service and includes a condenser filter with easy access from the top of the unit. The refrigeration system components are assembled on a high density expanded polypropylene platform that is removable from the main unit. A unique ducted air flow system achieves uniform air distribution within the cabinet to eliminate hot spots. Condensate removal is accomplished with a top mounted energy efficient non-electric evaporation system. A thermostatic expansion valve (TXV) controls the flow of environmentally friendly R290 refrigerant through the evaporator. Solid state digital controls monitor the operation and performance of the refrigeration system. The controls also provide visual high and low temperature and high and low voltage alarms. A LED display shows the cabinet temperature and is adjustable to Fahrenheit or Celsius. 115 volt units are equipped with a ten foot cord and plug (20.0 amps or less).

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Casters

HS-3546/HS-3547



HS-5035



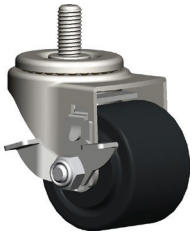
HS-5036 without brakes



HS-5036 with brakes



HS-5320/HS-5321



Accessory Number	Description	For use with	Weighted Capacity per caster
HS-3546	4” caster with 5/8”-11 thread, Set of 4 (2 with brakes)	Used on Steelheart Uprights, all models. C___S-xxx from aux code E-8 to H-5	400 lbs.
HS-3547	4” caster with 5/8”-11 thread, Set of 6 (3 with brakes)		
HS-5035	4” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Undercounters	175 lbs.
HS-5036	6” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Worktop, Sandwich Prep	350 lbs.
HS-5037	2” caster 1/2”-13 thread, Set of 4 (2 with brakes)	LP Undercounter models	220 lbs.
HS-5320	3-3/8” caster, 1/2”-13 thread, Set of 4 (2 with brakes)	Pizza Prep Tables for ADA Compliant dimensions	300 lbs.
HS-5321	3-3/8” caster, 1/2”-13 thread, Set of 6 (3 with brakes)		

Hoshizaki reserves the right to change specifications without notice.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Legs

DM LEGS



LP-4 LEG



LP-6P-LEG



LP-6 Flange Leg



LP-6 LEG



Accessory Name/Number	Kit Number	Part Number	Description	Stud Length	For use with	Weighted Capacity per leg
	HS-2071, HS-2072, HS-2073	4A2091-01	Stainless, height 6", 5/8-11, 4pk	3/4" thread	DCM-300, DCM-500, SD Stands	2000 lbs.
DM LEGS			Black, height 4", 3/8-16, 1/2 4pk	5/8" thread	DM-200B	2000 lbs.
		4A2145-01	Black epoxy, height 4", 3/8-11, 4pk	5/8" thread	DCM-271BAH(-OS)	1000 lbs.
LP-6P LEG		4A2525-01	Black, height 6", 5/8-11, 4pk	3/4" thread	B-250, B-500, BD-500 B-700, B-800, B-900 KM-81, KM-116, KM-161, KM-231, KM-301 DB-200H, F-330(-C), F-300, F-500, IM-200	2000 lbs.
LP-6 FLANGE LEG		4A2526-01	Black epoxy, height 6", 5/8-11, 4pk	3/4" thread	SD-200, SD-271, SD-500, SD-750, B-300, BD-300, DB-130H, DKM-500	2000 lbs.
		4A2966-01	Stainless, height 6", 3/8-16, 4pk	3/4" thread	PR46A(-D2, D4)	500 lbs.
LP-6 LEG		4A0930-01	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-02	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-03	Stainless, height 6", 5/8-11, 2pk	1/2" thread		2000 lbs.
	HS-3585	4A0930-04	Stainless, height 6", 5/8-11, 4pk	3/4" thread		2000 lbs.
		4A0930-05	Stainless, height 6", 1/2-13, 4pk	3/4" thread		2000 lbs.

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Hoshizaki reserves the right to change specifications without notice.

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

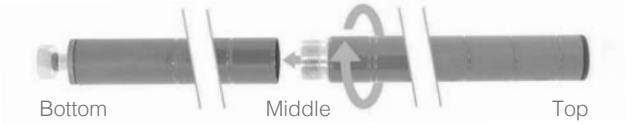
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

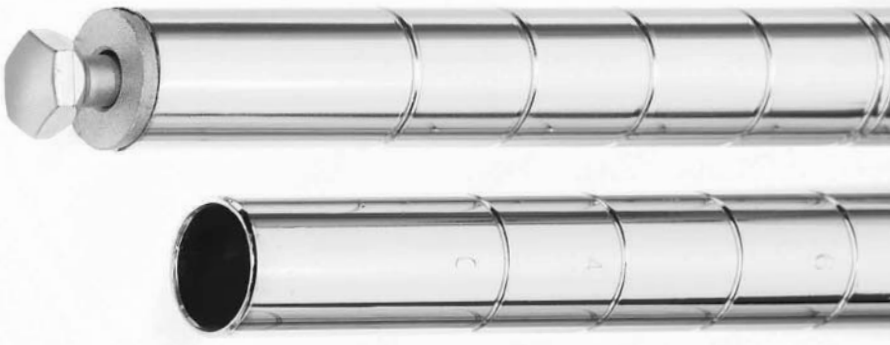
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

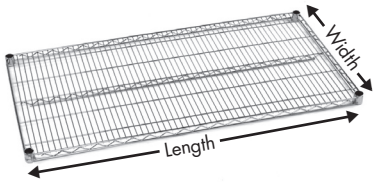
Centaur™

Wire Shelving

PROJECT NAME: _____ LOCATION: _____

ITEM: _____ MODEL: _____





LOAD CAPACITY:
Up to 48" (1219mm) Length
= 800 lbs. (363kg)
54"-72" (1372-1829mm) Length
= 600 lbs. (272kg)

WIRE SHELVING

- **Unique Design:** The open wire design of these heavy-gauge carbon-steel shelves minimizes dust accumulation and allows a free circulation of air, greater visibility of stored items and greater light penetration.
- **Versatile Construction:** Centaur wire shelving can change as quickly as your needs change.
- **Fast, Secure Assembly:** Posts have circular grooves at 1" (25mm) intervals. A tapered split sleeve snaps together around each post. Tapered openings in the shelf corners slide over the tapered split sleeves providing a positive lock. Shelf is assembled in minutes without the use of any special tools.
- **Shelf Mat Wires:** Run front to back, allowing you to slide items on and off shelves smoothly.
- **Shelf Accessibility:** Shelves can be loaded/unloaded easily from all sides. This open construction allows use of maximum storage space of cube.
- **Adjustability:** Shelves can be adjusted at 1" (25mm) intervals along the entire length of the post.
- **Finish Options:** Chromate for dry storage. Green epoxy with chromate substrate for walk-in coolers and other damp environments.
- **Posts:** Bolt levelers compensate for surface irregularities on stationary posts. Posts also available for mobile application.

WIRE SHELVES

(in.)	(mm)	Approx. Weight Per Shelf (lbs.)	(kg)	Pack Qty.	Chromate	Green Epoxy
14x24	355x610	6	2.7	4	C1424C	C1424K
14x30	355x760	7	3.2	4	C1430C	C1430K
14x36	355x914	8	3.6	4	C1436C	C1436K
14x42	355x1066	9.5	4.3	4	C1442C	C1442K
14x48	355x1219	10.5	4.7	4	C1448C	C1448K
14x60	355x1524	14	6.3	2	C1460C	C1460K
14x72	355x1829	17	7.7	2	C1472C	C1472K
18x24	457x610	7	3.2	4	C1824C	C1824K
18x30	457x760	8	3.6	4	C1830C	C1830K
18x36	457x914	9.5	4.3	4	C1836C	C1836K
18x42	457x1066	11	5	4	C1842C	C1842K
18x48	457x1219	12	5.4	4	C1848C	C1848K
18x54	457x1372	14.5	6.6	2	C1854C	C1854K
18x60	457x1524	17	7.7	2	C1860C	C1860K
18x72	457x1829	20	9.1	2	C1872C	C1872K

(in.)	(mm)	Approx. Weight Per Shelf (lbs.)	(kg)	Pack Qty.	Chromate	Green Epoxy
21x24	533x610	8	3.6	4	C2121C	C2121K
21x30	533x760	9	4.1	4	C2130C	C2130K
21x36	533x914	11	5	4	C2136C	C2136K
21x42	533x1066	12	5.4	4	C2142C	C2142K
21x48	533x1219	14	6.4	4	C2148C	C2148K
21x54	533x1372	16	7.3	2	C2154C	C2154K
21x60	533x1524	18	8.2	2	C2160C	C2160K
21x72	533x1829	24	10.9	2	C2172C	C2172K
24x24	610x610	9	4.1	4	C2424C	C2424K
24x30	610x760	11	5.0	4	C2430C	C2430K
24x36	610x914	13	5.9	4	C2436C	C2436K
24x42	610x1066	15	6.8	4	C2442C	C2442K
24x48	610x1219	16	7.3	4	C2448C	C2448K
24x54	610x1372	19	8.6	2	C2454C	C2454K
24x60	610x1524	21	9.5	2	C2460C	C2460K
24x72	610x1829	26	11.8	2	C2472C	C2472K

Specifications subject to change without notice.

Approvals:

Centaur™

POSTS

Approx. Weight Per Post (lbs.)	(kg)	STATIONARY Height* (in.)	(mm)	Chrome	Green Epoxy	MOBILE Height** (in.)	(mm)	Chrome	Green Epoxy
1/2	0.3	7 1/2	191	C7C	C7K	6 3/4	171	C7UC	C7UK
1	0.5	14 1/2	370	C13C	C13K	13 3/4	349	C13UC	C13UK
2	0.9	34 1/2	875	C33C	C33K	33 3/4	857	C33UC	C33UK
3	1.4	54 9/16	1385	C54C	C54K	53 13/16	1366	C54UC	C54UK
3 1/2	1.6	62 9/16	1590	C63C	C63K	61 13/16	1570	C63UC	C63UK
4	1.8	74 5/8	1895	C74C	C74K	73 7/8	1873	C74UC	C74UK
5	2.3	86 5/8	2200	C86C	C86K	85 7/8	2181	C86UC	C86UK

*Height includes leveling bolt and cap on stationary units.
**Casters sold separately. A 5" (127mm) caster adds approximately 6" (152mm) to overall height.



Posts are grooved at 1" (25mm) increments and numbered at 2" (50mm) increments. Posts are double-grooved every 8" (203mm) for easy identification.

Shelf Dividers for Shelves



Keep shelf contents orderly with these 8" (203mm) high, pressure-fit dividers.

Shelf Width (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Plated
18	457	2.25	1.0	CDD18C
24	610	2.75	1.3	CDD24C

Stackable Shelf Ledges



4" (100mm) High

Shelf Width (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Plated
14	355	0.83	0.36	CL14-4C
18	457	1.5	0.68	CL18-4C
24	610	2.0	0.9	CL24-4C
30	760	2.25	1.03	CL30-4C
36	914	2.75	1.25	CL36-4C
48	1219	3.75	1.68	CL48-4C
60	1524	4.0	1.81	CL60-4C
72	1828	5.0	2.25	CL72-4C

Note: Actual ledge length is approximately 1" (25mm) shorter than nominal shelf length/width.

Replacement Plastic Split Sleeves



One bag required per shelf; 4 pairs per bag.
Cat. No. C9985

"S" Hook



Two are required for each storage level.
Cat. No. C9995Z

Foot Plates



Use to bolt units to the floor, or when a broader, more stable foot is desired.
Zinc. Cat. No. C9993Z

Stem Casters — Resilient Rubber (Order By Each)



Use with posts to create a mobile shelving unit to meet your special needs. Each caster is constructed of resilient rubber wheels and plated components. Load rating is 200 lbs. (90kg) per caster. Sold by the piece.

Wheel Diameter (in.)	(mm)	Face (in.)	(mm)	Load Rating (lbs.)	(kg)	Type	Wheel Tread	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No.
5	127	1 1/4	32	200	90	Stem/Swivel	Resilient	2 1/2	1.1	C5
5	127	1 1/4	32	200	90	Stem/Brake	Resilient	2 5/8	1.2	C5B

Stem Caster Kit — High Modulus Rubber (One Kit = Four Casters)



Kit consists of four swivel casters with brakes. Each caster is constructed of durable, non-marking high modulus rubber. Load rating is 300 lbs. (136kg) per caster.

Wheel Diameter (in.)	(mm)	Face (in.)	(mm)	Load Rating (lbs.)	(kg)	Type	Wheel Tread	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No.
5	127	1 1/4	32	300	136	Stem/Brake	Flat High Modulus Rubber	9	4.1	C5FBA-4

Direct Wall Mounts



Single Shelf Support



Double Shelf Support

Each consists of one shelf support and mounting plate. Use single support at shelf ends; double support for adjoining shelves. (Single — Two required per shelf.)

Shelf Width (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	SINGLE Chrome	SINGLE Green Epoxy	Approx. Pkd. Wt. (lbs.)	(kg)	DOUBLE Chrome	DOUBLE Green Epoxy
14	355	1 1/2	0.7	C1WD14C	C1WD14K	3	1.4	C2WD14C	C2WD14K
18	457	2	0.9	C1WD18C	C1WD18K	4	1.8	C2WD18C	C2WD18K
24	610	3	1.4	C1WD24C	C1WD24K	4.5	2	C2WD24C	C2WD24K

Warranty
Green Epoxy shelves, posts, and accessories have a limited 7 year warranty against corrosion.

L03-205 - CENTAUR-NP - Rev. 4/12

Information and specifications are subject to change without notice. Please confirm at time of order.

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

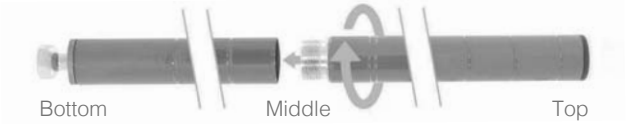
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

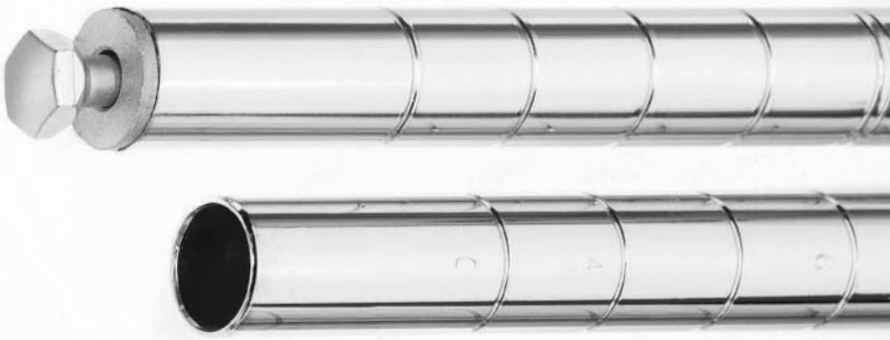
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	**C1424C**	**C1424K**
14x30	457x914	9.5	4.2	**C1430C**	**C1430K**
14x36	457x1060	11.3	5.0	**C1436C**	**C1436K**
14x42	457x1219	13.0	5.8	**C1442C**	**C1442K**
14x48	457x1372	14.8	6.6	**C1448C**	**C1448K**
14x60	457x1524	16.5	7.4	**C1460C**	**C1460K**
14x72	457x1829	19.8	8.8	**C1472C**	**C1472K**
18x24	457x610	8.0	3.6	**C1824C**	**C1824K**
18x30	457x760	7.8	3.5	**C1830C**	**C1830K**
18x36	457x914	9.5	4.2	**C1836C**	**C1836K**
18x42	457x1060	11.3	5.0	**C1842C**	**C1842K**
18x48	457x1219	13.0	5.8	**C1848C**	**C1848K**
18x54	457x1372	14.8	6.6	**C1854C**	**C1854K**
18x60	457x1524	16.5	7.4	**C1860C**	**C1860K**
18x72	457x1829	19.8	8.8	**C1872C**	**C1872K**
21x24	530x610	8.0	3.6	**C2124C**	**C2124K**
21x30	530x760	9.5	4.2	**C2130C**	**C2130K**
21x36	530x914	11.3	5.0	**C2136C**	**C2136K**
21x42	530x1060	12.5	5.6	**C2142C**	**C2142K**
21x48	530x1219	14.3	6.4	**C2148C**	**C2148K**
21x54	530x1372	16.5	7.4	**C2154C**	**C2154K**
21x60	530x1524	18.3	8.1	**C2160C**	**C2160K**
21x72	530x1829	21.5	9.6	**C2172C**	**C2172K**
24x24	610x610	9.5	4.2	**C2424C**	**C2424K**
24x30	610x760	11.3	5.0	**C2430C**	**C2430K**
24x36	610x914	13.0	5.8	**C2436C**	**C2436K**
24x42	610x1060	14.0	6.3	**C2442C**	**C2442K**
24x48	610x1219	15.5	6.9	**C2448C**	**C2448K**
24x54	610x1372	18.3	8.1	**C2454C**	**C2454K**
24x60	610x1524	20.0	8.9	**C2460C**	**C2460K**
24x72	610x1829	23.3	10.4	**C2472C**	**C2472K**

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

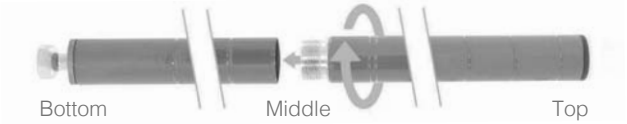
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	**C7C**	**C7K**
13	330	0.9	0.4	**C13C**	**C13K**
33	838	2	0.9	**C33C**	**C33K**
54	1372	3.4	1.5	**C54C**	**C54K**
63	1600	3.6	1.6	**C63C**	**C63K**
74	1880	4.1	1.9	**C74C**	**C74K**
86	2184	4.8	2.2	**C86C**	**C86K**

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	**C74TSPC-4PK**	**C74TSPK-4PK**



POSTS (MOBILE)

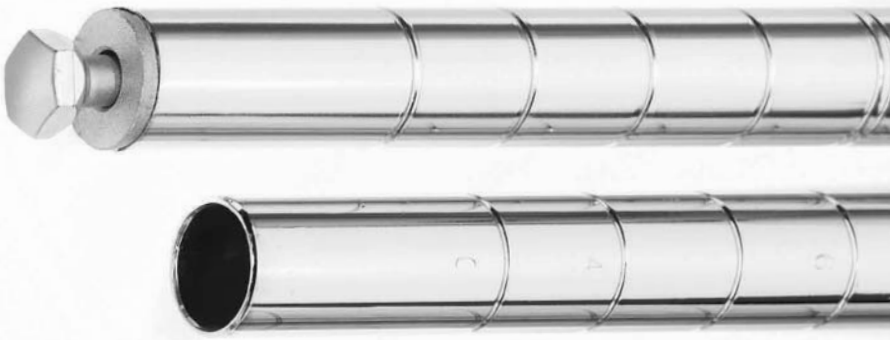
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	**C7UC**	**C7UK**
13	330	0.8	0.4	**C13UC**	**C13UK**
33	838	1.9	0.9	**C33UC**	**C33UK**
54	1372	3.3	1.5	**C54UC**	**C54UK**
63	1600	3.5	1.6	**C63UC**	**C63UK**
74	1880	4	1.8	**C74UC**	**C74UK**
86	2184	4.7	2.1	**C86UC**	**C86UK**

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

031819

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PBHS-14" PRO-BOWL HAND SINKS

FOR SPLASH MOUNT FAUCETS

FEATURES:

- ONE PIECE DEEP DRAWN BOWL
- ALL SINK BOWLS HAVE LARGE LIBERAL RADII CORNERS
- INCLUDES BASKET DRAIN
- SPLASH MOUNT FAUCET HOLES 4" ON-CENTER
- 1-1/2" DRAIN PLUMBING CONNECTION

CONSTRUCTION:

- BOWL: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.

MATERIAL:

- BOWL: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH
- BRACKET: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH



PBHS-W-1410



PBHS-W-1410-P



PBHS-W-1410-SSLR



PBHS-W-1410-SSR



PBHS-W-1410-P-SSLR



PBHS-W-1410-4D

PRO-BOWL HAND SINKS

MODEL #	QTY
PBHS-W-1410	
PBHS-W-1410-P	
PBHS-W-1410-SSL	
PBHS-W-1410-SSR	
PBHS-W-1410-SSLR	
PBHS-W-1410-P-SSLR	
PBHS-W-1410-4D	
PBHS-W-1410-PD	

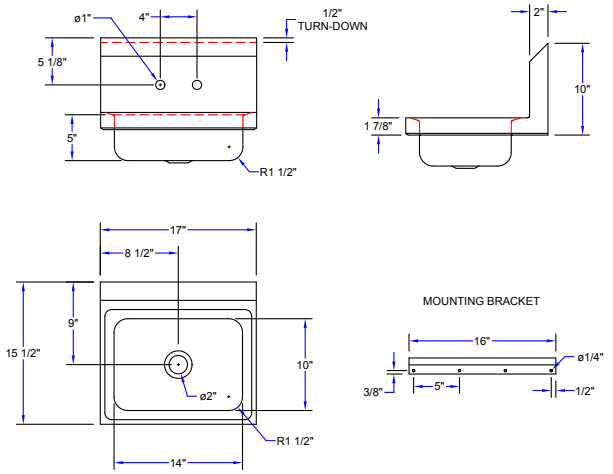
-P INCLUDES FAUCET

OPTIONAL ACCESSORIES

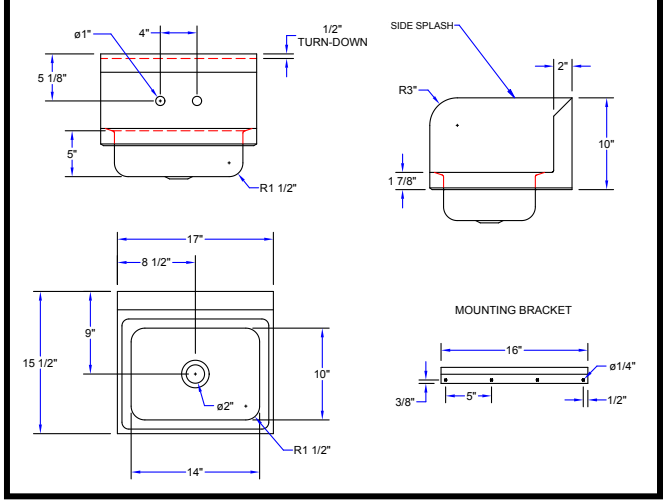
DESCRIPTION	QTY
FAUCETS	
SIDE SPASH	
ADA WRIST BLADES	
TOWEL DISPENSER	
LEVER WASTES	
OVER FLOWS	
P-TRAPS	

DETAILED SPECIFICATIONS

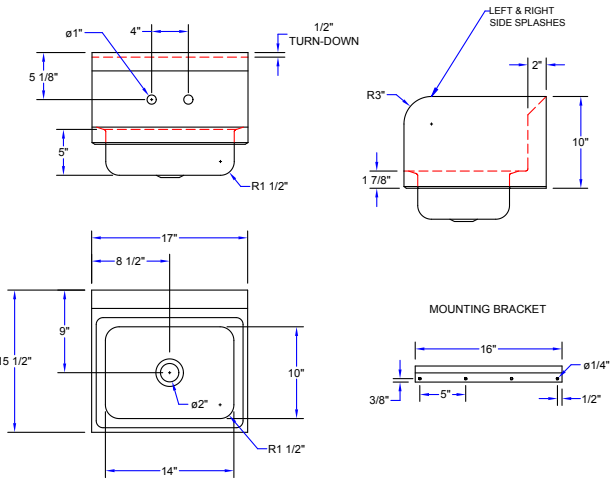
PBHS-W-1410



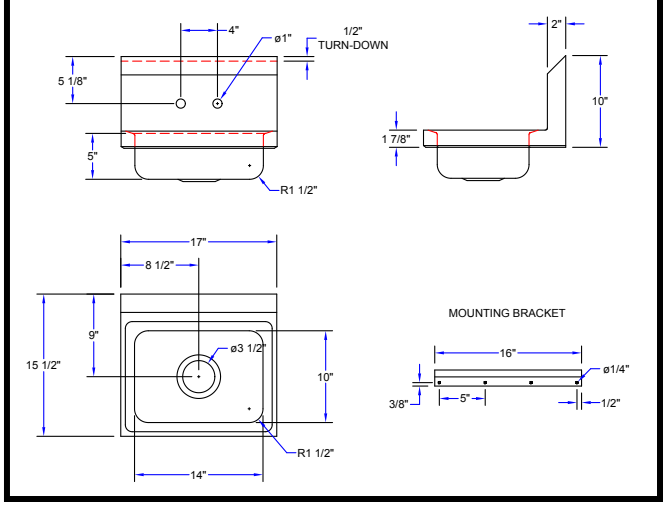
PBHS-W-1410-SSL, PBHS-W-1410-SSR



PBHS-W-1410-SSLR



PBHS-W-1410-4D



PRO-BOWL HAND SINKS

MODEL #	BOWL SIZE (LxWxD)	DRAIN SIZE	FAUCET LOCATION	SIDE SPLASH
PBHS-W-1410	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	N/A
PBHS-W-1410-P	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-SSL	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH
PBHS-W-1410-SSR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	RH
PBHS-W-1410-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER	LH & RH
PBHS-W-1410-P-SSLR	14" X 10" X 5"	1-7/8"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	LH & RH
PBHS-W-1410-4D	14" X 10" X 5"	3-1/2"	SPLASH MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A
PBHS-W-1410-PD	14" X 10" X 5"	1-7/8"	DECK MOUNT: 4" ON-CENTER (FAUCET INCLUDED)	N/A

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

PRODUCT NAME: FAUCET 4BSLH

JOB NAME:

QUANTITY: ITEM NO.:

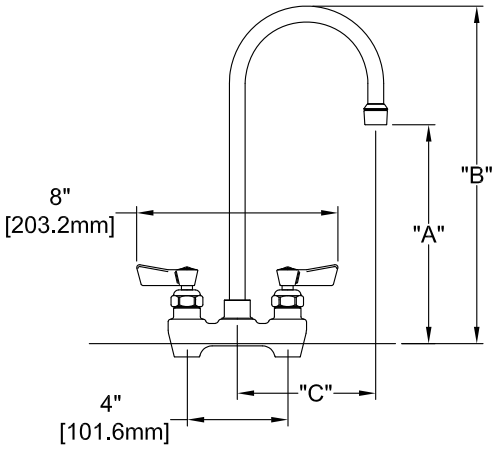
SPECIAL CONFIGURATION
☐ _____ CHECK BASE MODEL AND OPTIONS

MODEL:

- ☐ 3616 FAUCET 4BSLH 12RGN PER 2.20 GPM
- ☐ 2003 FAUCET 4BSLH 06RGN PER 2.20 GPM
- ☐ 85391 FAUCET 4BSLH 10RGN PER 2.20 GPM
- ☐ 73370 FAUCET 4BSLH 12RGN PCA SPRAY 0.35 GPM
- ☐ 73371 FAUCET 4BSLH 06RGN PCA SPRAY 0.35 GPM

OPTIONS OR MODIFICATIONS:

- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ IN-LINE DUAL CHECK VALVE
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____



MODEL	DIM "A"	DIM "B"	DIM "C"
3615	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
1996	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]
85391	6 1/4" [159.0mm]	10 1/2" [266.2mm]	5" [127.0mm]
73370	9-3/4" [247.7mm]	13-1/2" [342.9mm]	5-1/2" [139.7mm]
73371	6" [152.4mm]	9-3/4" [247.7mm]	3-1/2" [88.9mm]

FEATURES:

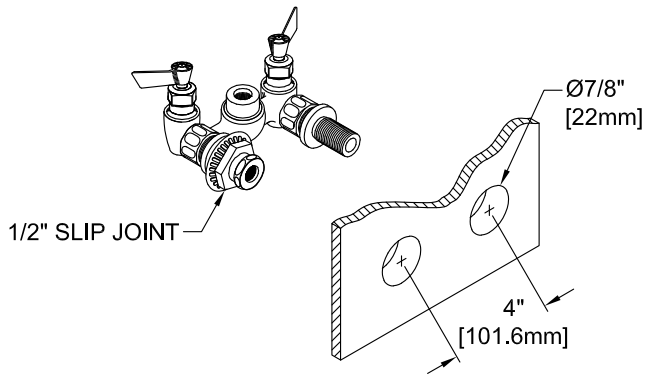
CONTROL VALVE
* 4" C/C BACKSPLASH
* INTERNAL SPRING LOADED CHECK VALVES
* SWIVELING SEAT DISKS
* HOT SIDE STEM - LEFT HAND
* COLD SIDE STEM - RIGHT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT INCLUDED

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 160°F MAX.
* PRESSURE 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 4.5 LBS

PRODUCT COMPLIANCE:
* ASME A112.18.1 / CSA B125.1
* NSF 61 - Section 9
* NSF 372 (Low Lead Content)

ROUGH-IN:



FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. FAHB-HW-4BSLL

DELFIELD®

Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

4448NP Mega Top

Front-Breathing Self-Contained Mega Top Refrigerated Bases

Models

- 4448NP-6M Two section with doors, six pan capacity
- D4448NP-6M Two section with drawers, six pan capacity
- 4448NP-12M Two section with doors, twelve pan capacity
- D4448NP-12M Two section with drawers, twelve pan capacity
- 4448NP-18M Two section with doors, eighteen pan capacity
- D4448NP-18M Two section with drawers, eighteen pan capacity



4448NP-18M
Shown with optional display in nosing.

Standard Features

- Patented air screen ensures product stays cold without drying it out
- 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet or an existing line up
- Durable, rugged stainless steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable - it won't dent, chip or corrode and is backed by a limited lifetime warranty
- Delfield supplies 1/6 size pans and positive placement adapter bars for top opening
- Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance
- Mega top refrigerators are standard with 8" wide, dishwasher safe polyethylene cutting board mounted on heavy-duty brackets
- "D" prefix models feature Delfield's drawer system. Drawers are backed by a 10-year warranty on the track assembly
- Environmentally friendly R290 refrigerant
- High density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low
- Bent in full length handle
- Standard on 5" casters for easy cleaning and installation
- 10' cord and plug supplied
- One epoxy coated wire shelf standard, installed per door section
- ACT solid state electronic control
- Three year parts and labor warranty and an additional two year compressor parts warranty

Options & Accessories

- Various lid options
- 18" wide single tier overshelf
- Stainless steel finish on back
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height
- Door lock
- Exterior thermometer

4448NP Mega Top

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948
Fax: 800-669-0619

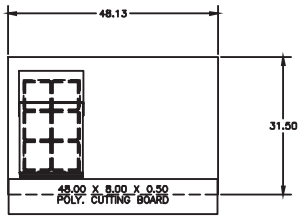
www.delfield.com
7057_4448NPP-M
11/18

WELBILT®

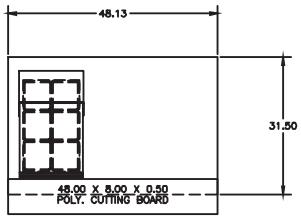
DELFIELD®

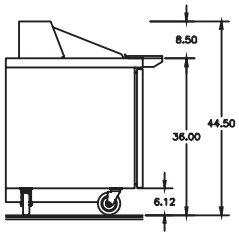
4448NP Mega Top

4448NP-6M Pan Cutout Configuration

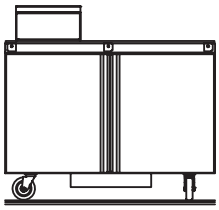


D4448NP-6M Pan Cutout Configuration

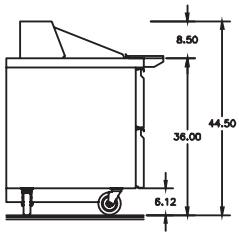




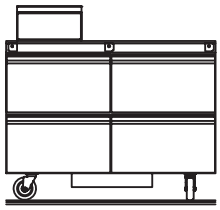
4448NP-6M Left Side View



4448NP-6M Elevation View

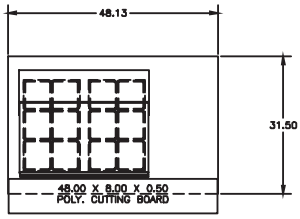


D4448NP-6M Left Side View

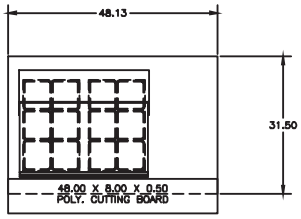


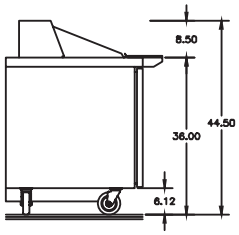
D4448NP-6M Elevation View

4448NP-12M Pan Cutout Configuration

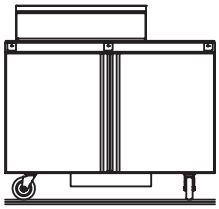


D4448NP-12M Pan Cutout Configuration

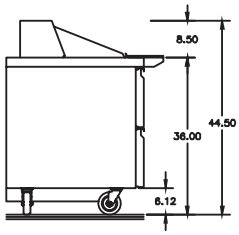




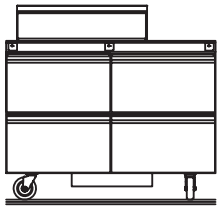
4448NP-12M Left Side View



4448NP-12M Elevation View



D4448NP-12M Left Side View



D4448NP-12M Elevation View

Welbilt reserves the right to make changes to the design or specifications without prior notice.

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

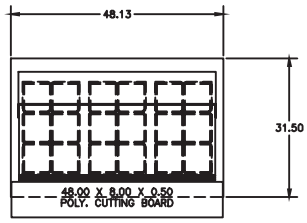
Phone: 800-733-8948
Fax: 800-669-0619

www.delfield.com
7057_4448NPP-M
11/18

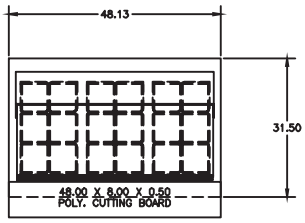
WELBILT®

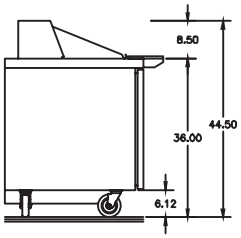
DELFIELD®

4448NP-18M Pan Cutout Configuration

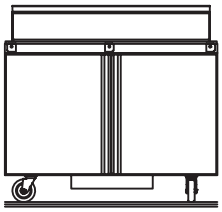


D4448NP-18M Pan Cutout Configuration

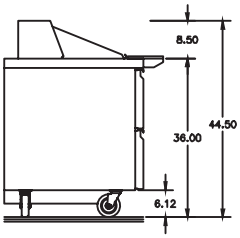




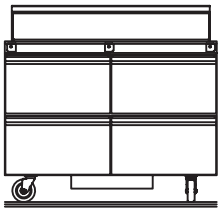
4448NP-18M
Left Side View



4448NP-18M
Elevation View



D4448NP-18M
Left Side View



D4448NP-18M
Elevation View

4448NP Mega Top

INSTALLATION NOTE:
Refrigeration system is designed so that air will flow under the unit, through the compressor area and out the front of the unit. Any restriction to this air flow path will void the warranties.

Specifications									
Model	1/6 Size Pan Cap.	# of Shelves	Shelf Area	Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP-6M	6	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-6M	6	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-12M	12	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-12M	12	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-18M	18	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-18M	18	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg

Welbilt reserves the right to make changes to the design or specifications without prior notice.

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948
Fax: 800-669-0619

www.delfield.com
7057_4448NPP-M
11/18

WELBILT®

DELFIELD®

Specifications

Exterior top is one-piece 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. Top of drawer unit has openings to accept eighteen 1/6 size plastic pans 4" (10cm) deep. Top of door unit has openings to accept eighteen 1/6 size plastic pans 4" or 6" (10cm or 15cm) deep. Adapter bars and 1/6 size pans are supplied by Delfield. Top has one telescoping lid is constructed of 20-gauge stainless steel. Temperature in top openings maintains 33°F (1°C) to 41°F (5°C), with pans recessed 2.5" (6.4cm) at 86°F ambient room temperature, meeting NSF 7 requirements. One 48" x 8" x .5" (121.9cm x 20.3cm x 1.3cm) polyethylene cutting board is mounted on the top at the front edge.

Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel.

Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high-density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of the cabinet. Evaporator coil is located on the interior rear wall of the cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior cabinet temperature of 33°F to 40°F (0°C to 4°C).

ACT control: ACT electronic, solid state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connections are 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15P plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable epoxy-coated wire shelf per door opening.

Drawers have 22-gauge stainless steel exterior with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Each top drawer will hold one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4"-6" (10.1cm-15.2cm) deep pans. Each bottom drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4" (10.1cm) deep pans. Pans are supplied by others.



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WELBILT®

MERRYCHEF
A Welbilt Brand

Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

High Speed Oven

Merrychef conneX® 16

Stainless steel



Carbon black



Features

- The conneX®16 is the most versatile, high speed oven on the market.
- An all-in-one unit ideally suited to rapidly cook, toast, grill and reheat fresh or frozen food, eliminating the need for other appliances.
- Cooking up to 20x faster than other cooking methods it can provide hot food on demand.
- It has the largest cavity 40.5cm x 40.5cm (16" x 16") to oven width 45.5cm (18") ratio, and fits on a 700mm worktop, perfect when space is at a premium.
- Suitable for front-of-house, operating quietly and easy to install due to ventless cooking capabilities through a built-in catalytic converter, eliminates the need for an extraction fan.
- Cool to touch exterior makes it safe to locate anywhere with no need to allow space around the unit.
- Easy to operate with a 7" HD widescreen display and new generation easyTouch®2.0, icon driven controller, ensuring consistent, high quality dishes.
- Stainless steel cavity and casework, with a sealed rounded edged cavity makes it easy to clean.
- Patented easy access front mounted monitored air filter.
- Wi-fi/ethernet connected with access to KitchenConnect cloud for easy menu updates (or, via a USB memory stick).

Options

- Stainless steel or carbon black finishes. Highly robust glass surrounds the easyTouch® 2.0 controller.

Included accessories

- Flat cook plate.
- Guarded hand paddle with supporting side walls.
- Cooking tray, full size.
- Cool down pan.
- Cook plate liner.

For a wide range of accessories recommended to get greater flexibility out of the conneX®16 and significantly reduce cleaning time visit **www.merrychef.com/products/accessories**

Specifications

High speed Technology® combines three heat technologies:
-Microwave
-Convection
-Tuned impingement.

MICROWAVE POWER

- Microwave setting options: Off and 5-100% in 1% increments.
- Microwave distribution system uses a rotating active antenna to ensure even heating throughout the food.

CONVECTED HEAT

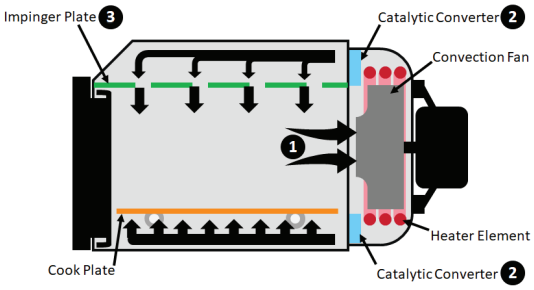
- Temperature setting options: Off and 212°F (100°C) to 527°F (275°C) in 1°C increments.
- The Heat distribution system is via Tuned Impingement, ensuring the most even browning.

VENTILATION

- Ventless certification. EPA 202 tested (8 hr).
- Internal catalytic filtration to limit grease and odour emissions.

easyTouch® 2.0 CONTROL SYSTEM

- Icon driven, HD colour touch screen control panel with unlimited storage for multi-stage cooking profiles.
- Each cooking profile offers up to six (6) stages with programmable cooking times, microwave power settings and written and/or pictorial user instructions for each stage.
- Self diagnostics capability to monitor components.
- Easy menu updates or data transfer via USB memory stick and KitchenConnect cloud.



HOW IT WORKS
The convection fan pulls air in through the back of the cavity (1). This is then heated and returned to the cavity through the catalytic converters (2) and impinger plate (3) to produce an even heat pattern in the oven. This heat pattern allows food to cook evenly and produces a crisp golden finish, every time.

c UL us

NSF / ANSI 4

Merrychef conneX® 16

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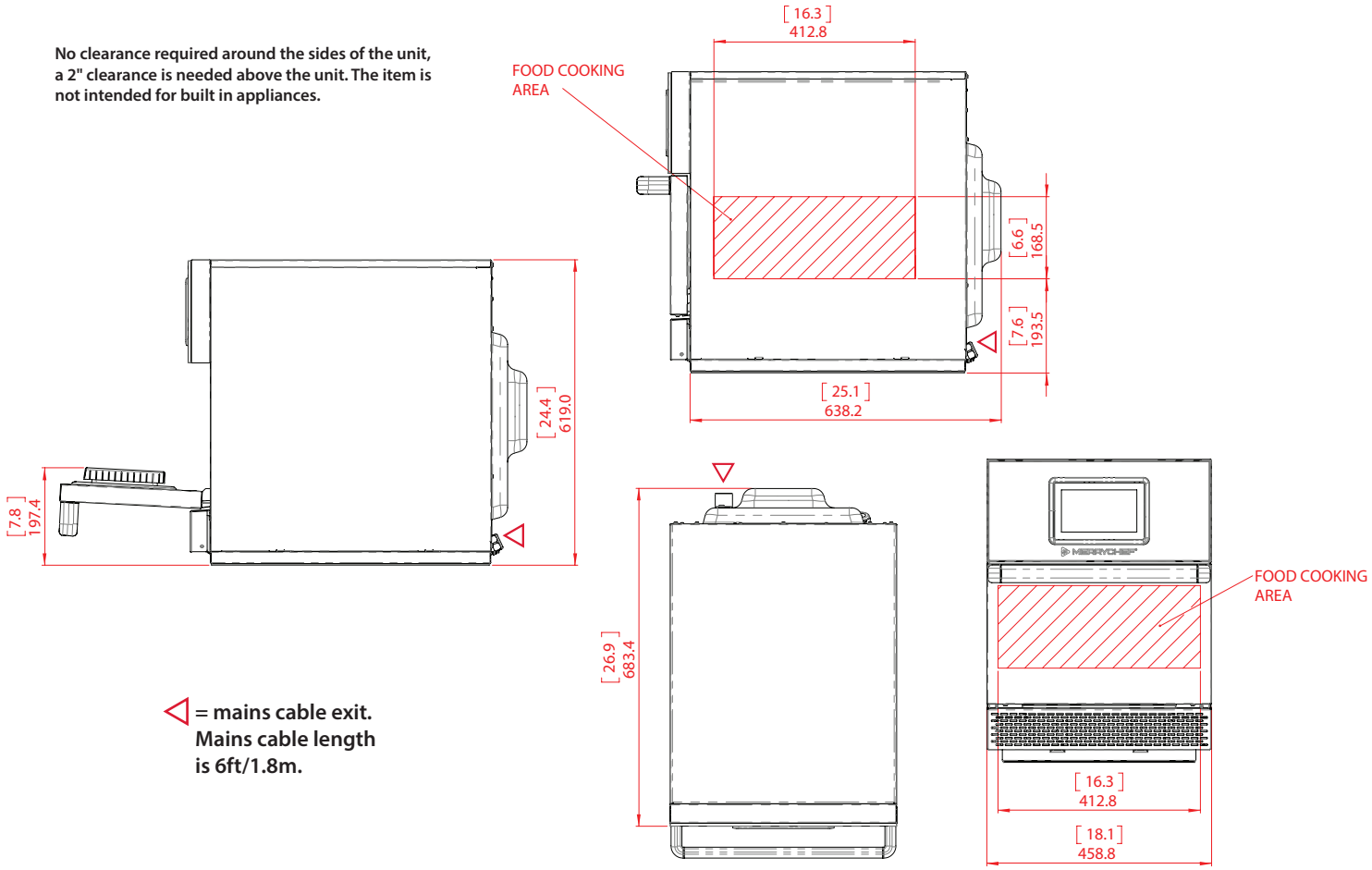
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WELBILT

MERRYCHEF®
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Merrychef conneX® 16

No clearance required around the sides of the unit, a 2" clearance is needed above the unit. The item is not intended for built in appliances.



◁ = mains cable exit. Mains cable length is 6ft/1.8m.

DIMENSIONS/WEIGHTS: BOXED OVEN

MODEL	OVERALL SIZE			WEIGHT
	HEIGHT	WIDTH	DEPTH	
conneX®16	33.7" (855 mm)	24.4" (620 mm)	32.3" (820 mm)	NET 175 lbs. (79.2 kg)

DIMENSIONS/WEIGHTS: OVEN

MODEL	OVERALL SIZE			WEIGHT
	HEIGHT	WIDTH	DEPTH	
conneX®16	24.4" (619 mm)	18.1" (458.8 mm)	26.9" (683.4 mm)	NET 148 lbs. (67.2 kg)

POWER REQUIREMENTS & OUTPUT

*This is not consumption. **This is approx. microwave power output.

Model	Model number	Finish	ELECTRICAL SUPPLY							POWER OUTPUT (APPROX.)		
			Voltage	Frequency	Arrangement and connections	Plug Type	Plug image	Plug phase current rating*	Max. power input	Microwave** (IEC 705) 100%	Convected heat	Combination mode
conneX16 ® high power	X16SBMV6DHL1CLUS	Stainless Steel	208-240V	60Hz	Twin Pole 2P + GND	NEMA L6-30P		30A	6000 W	2000 W	3200 W	2000 W** + 3200 W
	X16SBMV6DFL1CLUS		208-240V	60Hz	Twin Pole 2P + GND	NEMA 6-30P		30A	6000 W	2000 W	3200 W	2000 W** + 3200 W
	X16SBMV6DHL1BKUS	Carbon Black	208-240V	60Hz	Twin Pole 2P + GND	NEMA L6-30P		30A	6000 W	2000 W	3200 W	2000 W** + 3200 W
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Merrychef recommend installing a Type D circuit breaker whilst remaining in accordance with local regulations.

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Carbon black



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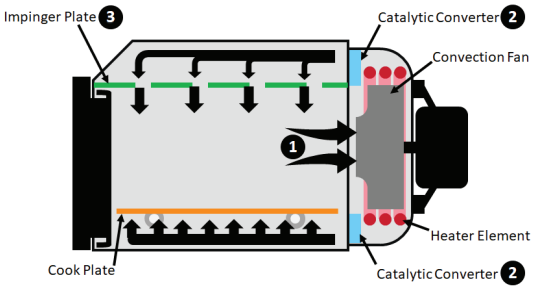
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Merrychef conneX® 16

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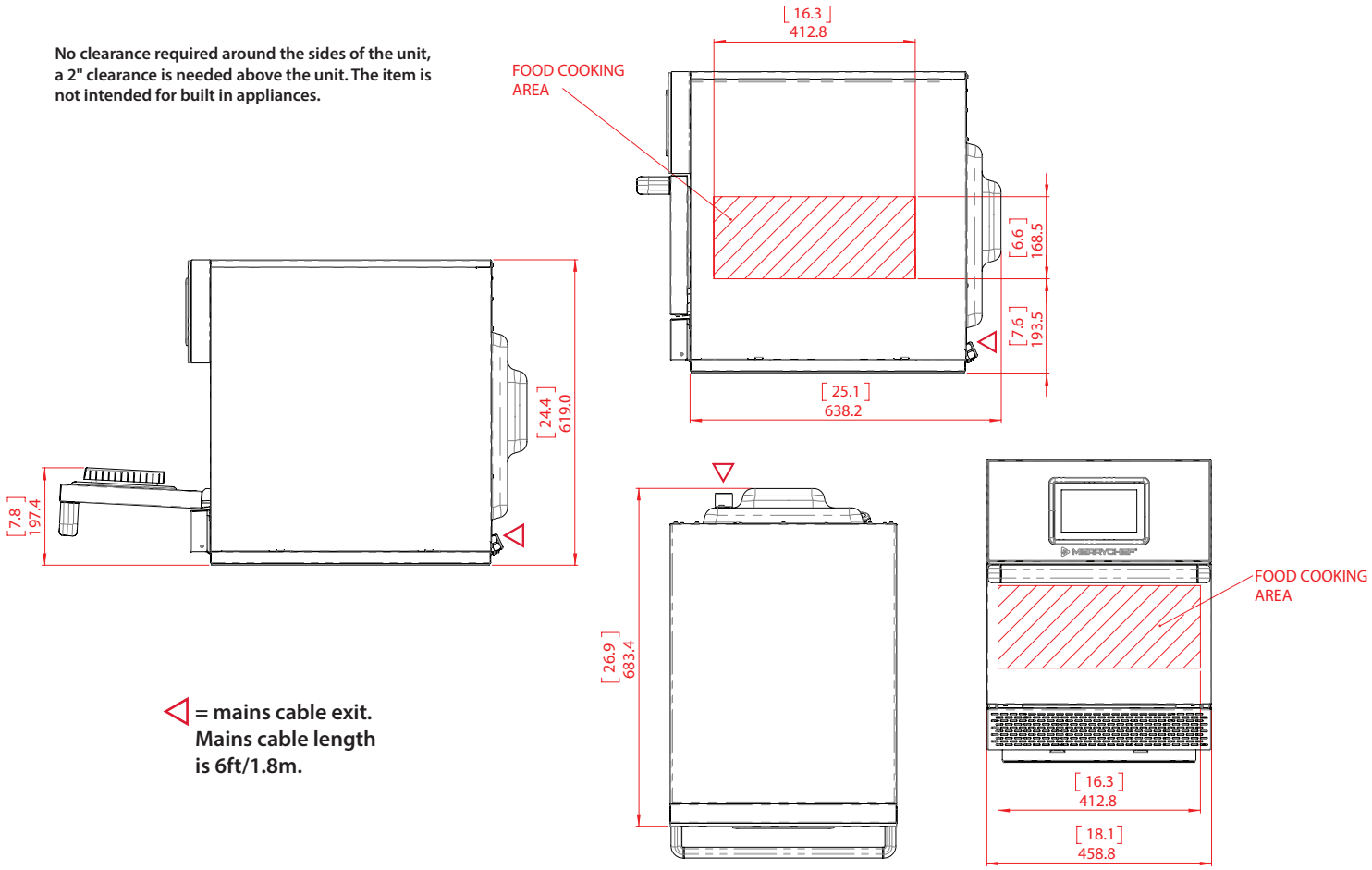
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Merrychef conneX® 16

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WELBILT®

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

MSA SERIES
Heavy Duty Gas Griddles



Model MSA48

SELL SHEET

GRIDDLE MODELS

- ❑ **MSA24- [ ]:** 24" w x 24" d
- ❑ **MSA36- [ ]:** 36" w x 24" d
- ❑ **MSA48- [ ]:** 48" w x 24" d
- ❑ **MSA60- [ ]:** 60" w x 24" d
- ❑ **MSA72- [ ]:** 72" w x 24" d

PLATE OPTIONS

- ❑ **101:** 1" Steel plate
- ❑ **201:** 30"d Steel plate
- ❑ **105:** 1" Hexavalent Chrome Plated
- ❑ **CO1:** ¾" Rapid Recovery™ Composite
  Note: 72" composite is not available.

Example: MSA36-201 is 36" Griddle with 30" deep steel plate
MSA48-CO1 is 48" Griddle with Rapid Recovery™ composite

STANDARD FEATURES

- Stainless steel front, sides and front top ledge with "Cool Bullnose" design
- Fully welded stainless and aluminized steel chassis frame
- 11" low profile cooking height on 4" adjustable legs
- 1" thick polished steel griddle plate with 12 gage, 4" stainless steel back and tapered side splashes
- Spatula wide 3½" grease gutter and chute is fully welded for easier cleaning and to stop grease migration
- One 27,000 BTU/hr. "U" shaped aluminized steel burner for every 12" of griddle width
- One embedded snap action thermostat per burner with temperature adjust from 200°F to 550°F on Steel or Chrome plate; temperature adjusts from 200°F to 450°F on Rapid Recovery™ plate
- Large 6 quart stainless steel grease drawer (2 drawers on 60" and 72" models)
- Heavy duty chromed thermostat knob guards
- One pilot safety valve for every two burners; safety will completely shut off gas to pilot and burners if pilot extinguishes
- Manual ignition
- Bottom heat shields
- ¾" rear gas connection and gas pressure regulator
- One year limited parts and labor warranty

SPECIFIER STATEMENT

Low profile heavy duty gas griddle, Vulcan Model No._____. Stainless steel front, sides and front top ledge. Fully welded stainless and aluminized steel body frame. 11" low profile cooking height on 4" legs. 1" thick polished steel griddle plate with 12 gauge, 4" stainless steel back and tapered side splashes. Grease chute is fully welded to stop grease migration. One 27,000 BTU/hr. "U" shaped aluminized steel burner and mechanical snap action thermostat for each 12" of griddle width. Chrome thermostat knob guards. Temperature adjusts from 200° to 550°F. One pilot safety for every two burners. 3½" wide stainless steel grease trough. ¾" rear gas connection and gas pressure regulator.

Exterior Dimensions:
_____"w x 33" d x 15½" h on 4" legs.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING
SPECIFY ALTITUDE WHEN ABOVE 2,000 FT.

OPTIONS

- ❑ Chrome plate (w/palmetto brush, scraper & blade)
- ❑ 30" Depth Steel Plate
- ❑ Rapid Recovery™ Plate
- ❑ Rear grease trough
- ❑ Under-device plumbing
- ❑ 10" Back splash
- ❑ Piezo ignition system (no ext. flame source required)
- ❑ Factory installed frame for clamshell accessory

ACCESSORIES *(see last page)*

MSA SERIES – Heavy Duty Gas Griddles

Approved by_____ Date_____ Approved by_____ Date_____

MSA SERIES
Heavy Duty Gas Griddles

INSTALLATION INSTRUCTIONS

INSTALLATION MANUAL

1. A gas pressure regulator supplied with the unit must be installed;

   Natural Gas 4.0" (102 mm) W.C.
   Propane Gas 10.0" (254 mm) W.C.

2. All models require a 6" (152 mm) clearance at both sides and rear adjacent to combustible and 0" from non-combustible constructions. All models require a 4" (102mm) bottom clearance and must be installed with minimum 4" legs.

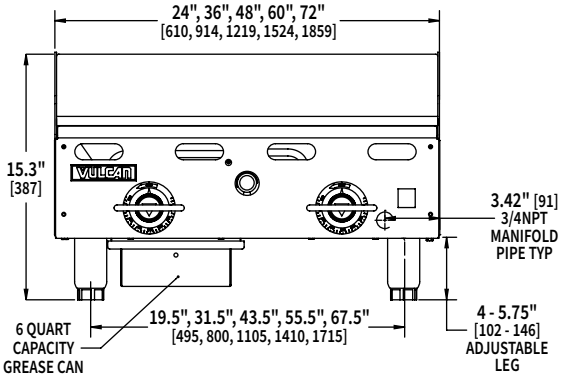
3. These units are manufactured for installation in accordance with ANSI/NFPA-70, National Electrical code.

   An adequate ventilation system is required for Commercial Cooking Equipment (NFPA No. 96). Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169.

4. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

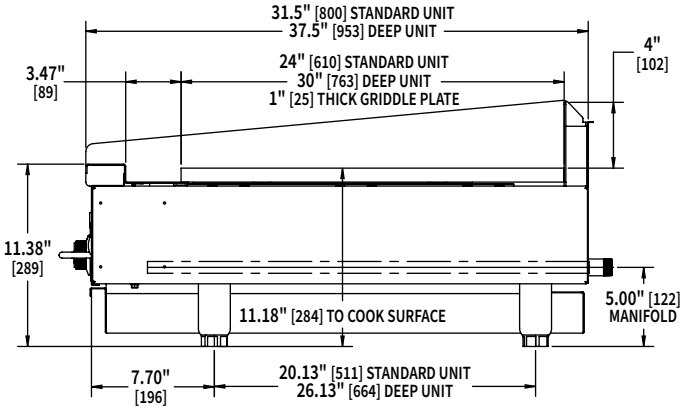
   NOTE: In The Commonwealth of Massachusetts
   All gas appliances vented through ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.

5. This appliance is manufactured for commercial installation only and is not intended for home use.

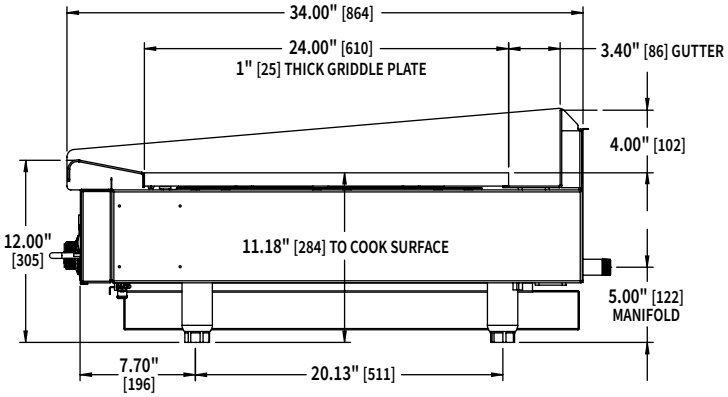


Front View

NOTES:
1. ADJUSTABLE LEGS ARE 2" IN DIAMETER. LEGS ARE RECESSED 1¼" FROM EACH SIDE.



Front Grease Trough - Side View



Rear Grease Trough - Side View

CAD and/or Revit Files Available

Model	Width	Depth	Overall Height*	Working Height*	Number of Burners	Total BTU/Hr.	Number of Drawers	Approximate Shipping Weight
MSA24	24"	31½"	15¼"	11⅛"	2	54,000	1	285 lbs./129 kg.
MSA36	36"	31½"	15¼"	11⅛"	3	81,000	1	400 lbs./181 kg.
MSA48	48"	31½"	15¼"	11⅛"	4	108,000	1	480 lbs./218 kg.
MSA60	60"	31½"	15¼"	11⅛"	5	135,000	2	650 lbs./295 kg.
MSA72	72"	31½"	15¼"	11⅛"	6	162,000	2	790 lbs./358 kg.

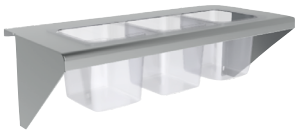
*These are nominal dimensions and can vary by +1.75" with adjustable legs.

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

VULCAN

MSA SERIES
Heavy Duty Gas Griddles

ACCESSORIES (packaged and sold separately)

	DESCRIPTION	ITEM #	FOR
	**PLATE RAIL** Stainless steel plate rail, 10⅝" depth *Note: Standard plate rail accessories are incompatible with rear grease trough griddles*	❑ **PLTRAIL-24** ❑ **PLTRAIL-36** ❑ **PLTRAIL-48** ❑ **PLTRAIL-60** ❑ **PLTRAIL-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**CONDIMENT RAIL** Stainless steel condiment rail, 10⅝" depth. Pans not included. *Note: Condiment rail accessories are incompatible with rear grease trough griddles*	❑ **CONRAIL-24** ❑ **CONRAIL-36** ❑ **CONRAIL-48** ❑ **CONRAIL-60** ❑ **CONRAIL-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**CUTTING BOARD** Stainless steel cutting board with Sani-Tuff®, 10⅝" depth *Note: Cutting board accessories are incompatible with rear grease trough griddles*	❑ **CUTBD-24** ❑ **CUTBD-36** ❑ **CUTBD-48** ❑ **CUTBD-60** ❑ **CUTBD-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**LEGS** 6" stainless steel legs	❑ **LEGS-GRD6**	All MSA
	**HOSE** ¾" x 4' long gas flex hose and quick disconnect	❑ **3/4QD-HOSE-4**	All MSA
	**BANKING STRIP** Griddle Banking Strip	❑ **BANKING-STRIP**	All MSA
	**EQUIPMENT STAND** Universal equipment stand 24"H, ½" marine edge, undershelf, stainless steel, 5" casters	❑ **STAND/C-24** ❑ **STAND/C-36** ❑ **STAND/C-48** ❑ **STAND/C-60** ❑ **STAND/C-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	INTEGRATED STAND Equipment stand integrated into griddle unit (37" working height)	❑ **ISTAND/C-24** ❑ **ISTAND/C-36** ❑ **ISTAND/C-48** ❑ **ISTAND/C-60** ❑ **ISTAND/C-72**	MSA24 MSA36 MSA48 MSA60 MSA72

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

ES-D-SnapFastQD

Engineering Specification

Job Name _____ Contractor _____
Job Location _____ Approval _____
Engineer _____ Contractor's P.O. No. _____
Approval _____ Representative _____
SKU _____

SnapFast® Quick-Disconnect Assemblies

Sizes: ½" to 1¼"

SnapFast Quick-Disconnect Assemblies feature flexible movement and the one-handed quick-disconnect fitting with a unique thermal shut-off design that automatically shuts off the gas when the internal temperature exceeds 350°F (177°C).



Features

SnapFast® One-Handed Quick-Disconnect

Quick-Disconnect	Brass body, aluminum collar
Thermal Shut-off	Shuts off gas when internal temperatures exceed 350°F (177°C)

Additional Components

Restraining Device	PVC coated, steel multi-strand cable and mounting hardware
Valve	Full port, brass body
Elbow	Malleable iron
*Deluxe Kits Include	The Dormont Blue Hose, valve, restraining device, elbows, SnapFast, display box

Specifications

The Dormont Blue Hose®

Tubing	Annealed, 304 stainless steel
Braiding	Multi-strand, stainless steel wire
Coating	Blue antimicrobial PVC, melts at 350°F (177°C); coating will not hold a flame
End Fittings	Carbon steel; zinc trivalent chromate
Stress Guard®	360° rotational end fitting at both ends

Safety System™ The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. The Safety System consists of the famous Dormont Blue Hose and a variety of accessories designed for improved safety and performance in commercial kitchens. Because they are manufactured in the USA under an ISO qualified production process and to multiple design certifications, you can Connect with Confidence with the Dormont Safety System.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

Dormont product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Dormont Technical Service. Dormont reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Dormont products previously or subsequently sold. Refer to the owner's manual for warranty information.

Dormont® A WATTS Brand

Approvals & Certifications

NSF/ANSI 169 – Special-purpose food equipment and devices
ANSI Z21.69 / CSA 6.16 – Connectors for moveable gas appliances
ANSI Z21.41 / CSA 6.9 – Quick-disconnect devices for use with gas fuel appliances
ANSI Z21.15 / CSA 9.1 – Manually operated gas valves for appliances, appliance connectors
Meets requirements of ANSI Z223.1 / NFPA 54 National Fuel Gas Code
Not for use in temperatures less than 32°F (0°C). For indoor use only.
Max operating pressure 1/2 psi.
Refer to the catalog for additional approvals and certifications or go to www.dormont.com.
A restraining device is required for all moveable gas equipment.

SnapFast® Quick-Disconnect Deluxe Kit Assembly

Ordering Information

CONFIGURATION	SIZE I.D.	24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
Deluxe Kit*	½"	1650KIT24	1650KIT36	1650KIT48	1650KIT60	1650KIT72
Basic Kit**		1650BPQR24	1650BPQR36	1650BPQR48	1650BPQR60	1650BPQR72
Hose Assembly***		1650BPQ24	1650BPQ36	1650BPQ48	1650BPQ60	1650BPQ72
Deluxe Kit*	¾"	1675KIT24	1675KIT36	1675KIT48	1675KIT60	1675KIT72
Basic Kit**		1675BPQR24	1675BPQR36	1675BPQR48	1675BPQR60	1675BPQR72
Hose Assembly***		1675BPQ24	1675BPQ36	1675BPQ48	1675BPQ60	1675BPQ72
Deluxe Kit*	1"	16100KIT24	16100KIT36	16100KIT48	16100KIT60	16100KIT72
Basic Kit**		16100BPQR24	16100BPQR36	16100BPQR48	16100BPQR60	16100BPQR72
Hose Assembly***		16100BPQ24	16100BPQ36	16100BPQ48	16100BPQ60	16100BPQ72
Deluxe Kit*	1¼"	16125KIT24	16125KIT36	16125KIT48	16125KIT60	16125KIT72
Basic Kit**		16125BPQR24	16125BPQR36	16125BPQR48	16125BPQR60	16125BPQR72
Hose Assembly***		16125BPQ24	16125BPQ36	16125BPQ48	16125BPQ60	16125BPQ72

BTU/hr Flow Capacity Natural Gas

(Flow rating BTU/hr 0.64 SP. GR. @ 0.5 inch WC pressure drop)

MODEL	SIZE I.D.	LENGTH				
		24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
1650BPQ	½"	87,000	77,000	68,000	60,000	55,000
1675BPQ	¾"	232,000	218,000	180,000	158,000	139,000
16100BPQ	1"	414,000	379,000	334,000	294,000	279,000
16125BPQ	1¼"	699,000	615,000	541,000	476,000	419,000

*** Deluxe Kits include:** The Dormont Blue Hose and restraining device, full port valve and (2) street elbows
****Basic Kits include:** The Dormont Blue Hose and restraining device, street elbow and SnapFast
*****Hose Assemblies include:** The Dormont Blue Hose, SnapFast and street elbow

Typical Installation



Options

The Dormont Blue Hose®



The Dormont Blue Hose is a commercial, moveable-grade gas connector designed for use with moveable equipment.

Moveable equipment is defined in ANSI Standard Z21.69/CSA 6.16 as gas utilization equipment that may be mounted on casters or otherwise be subject to movement.

SnapFast



- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



Restraining Device

- ANSI Z21.69 Standard section 1.7.4 states: Connectors when used on caster-mounted equipment shall be installed with a restraining device, which prevents transmission of the strain to the connector

Safety-Set®



Benefits

- Can be used with all caster-mounted equipment including cooking appliances, warming carts, salad bars, and refrigerators
- Crush Resistant
- Resistant to oils and greases
- Open-floor design allows appliance to rest level on the floor to ensure even cooking

Features

- Compatible with 4", 5", and 6" casters
- Certified to NSF/ANSI Standard 169 – Special Purpose Food Equipment & Devices
- Flexible, tough injection molded Thermoplastic Polyurethane (TPU)
- Able to withstand 1,000 PSI of crush pressure

Ordering Instructions:

The Saftey-Set wheel positioning product can be ordered individually or with the Blue Hose Kit.

The Safety-Set model name is "PS" and the ordering number is 0241002.

When ordering the Safety-Set with the Blue Hose kit, simply add the letters "PS" to the end of the model number.

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

Dormont®
A WATTS Brand

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ES-D-SnapFastQD 2110

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Item # _____ C.S.I. Section 11420

GRIDDLES & BROILERS

VCRH SERIES
RESTAURANT SERIES GAS HOTPLATE



Model VCRH36

- ☐ **VCRH12** 12" wide
- ☐ **VCRH24** 24" wide
- ☐ **VCRH36** 36" wide

STANDARD FEATURES

- Stainless steel front, sides and front top ledge.
- Full width front crumb trays.
- 13" cooking height on 4" adjustable legs.
- 25,000 BTU/hr. open burners with lift-off heads.
- Cast iron top grates.
- One infinite heat control valve for each burner.
- Standing pilot ignition system.
- ¾" rear gas connection and convertible gas pressure regulator for LP service.
- Constructed standard for natural gas service. LP conversion kit supplied with unit.
- One year limited parts and labor warranty.

SPECIFICATIONS

Low profile gas hotplate, Vulcan model No._____. Stainless steel front, sides and front top ledge. 13" cooking height on 4" legs. 25,000 BTU/hr. open burners with lift-off heads. Cast iron top grates. Full width front crumb trays. One infinite heat control valve for each burner. Standing pilot ignition system. ¾" rear gas connection and convertible gas pressure regulator for LP service.

Exterior Dimensions:
_____"w x 29.3" d x 13.3" h on 4" legs.

CSA Design Certified. NSF Certified.

NOTE: Models are constructed standard for natural gas service. Propane conversion kit is supplied with the unit. Conversion is the customer's responsibility. Please indicate propane or natural gas when processing your order.

NOTE: Elevation orifice kit is available free of charge for high-elevation applications. Installation is the customer's responsibility. Please indicate elevation when processing your order.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

GRIDDLES & BROILERS

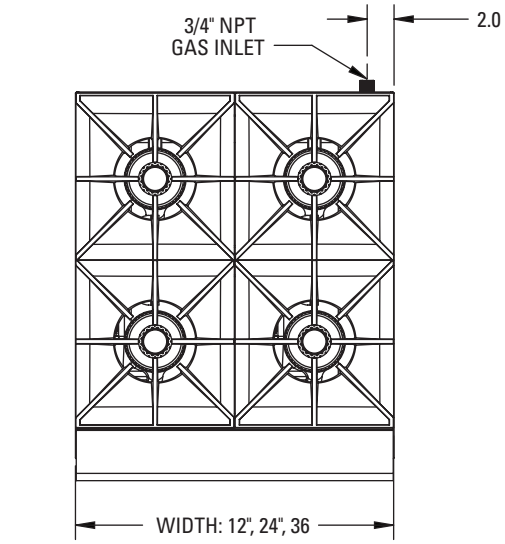
VCRH SERIES
RESTAURANT SERIES GAS HOTPLATE

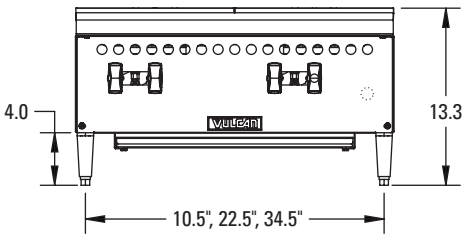
INSTALLATION INSTRUCTIONS:

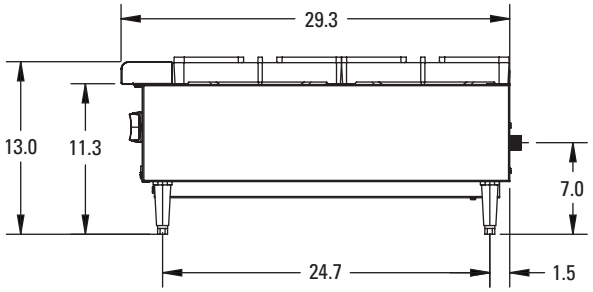
1. A gas pressure regulator supplied with the unit must be installed:
   Natural Gas 4.0" (102 mm) W.C.
   Propane Gas 10.0" (254 mm) W.C.
2. All models require a 11" (279 mm) clearance at both sides and 11" (279 mm) to the rear adjacent to combustible constructions. All models require 0" clearance at both sides and to the rear adjacent to non-combustible constructions. All models require a 4" (102mm) bottom clearance and must be installed with minimum 4" legs.

   An adequate ventilation system is required for Commercial Cooking Equipment (NFPA No. 96). Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169.
3. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

   NOTE: In The Commonwealth of Massachusetts
   All gas appliances vented through ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.
4. This appliance is manufactured for commercial installation only and is not intended for home use.







MODEL	WIDTH	DEPTH	OVERALL HEIGHT*	WORKING HEIGHT*	NO. OF BURNERS	TOTAL BTU/HR	NO. OF DRAWERS	APPROX. SHIP. WT.
VCRH12	12"	29.3"	13.3"	13"	2	50,000	1	140 lbs/63 kg
VCRH24	24"	29.3"	13.3"	13"	4	100,000	1	207 lbs/93 kg
VCRH36	36"	29.3"	13.3"	13"	6	150,000	2	250 lbs/113 kg

*These are nominal dimensions and can vary by +1.75" with adjustable legs.

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

ES-D-SnapFastQD

Engineering Specification

Job Name _____ Contractor _____
Job Location _____ Approval _____
Engineer _____ Contractor's P.O. No. _____
Approval _____ Representative _____
SKU _____

SnapFast® Quick-Disconnect Assemblies

Sizes: ½" to 1¼"

SnapFast Quick-Disconnect Assemblies feature flexible movement and the one-handed quick-disconnect fitting with a unique thermal shut-off design that automatically shuts off the gas when the internal temperature exceeds 350°F (177°C).



Features

SnapFast® One-Handed Quick-Disconnect

Quick-Disconnect	Brass body, aluminum collar
Thermal Shut-off	Shuts off gas when internal temperatures exceed 350°F (177°C)

Additional Components

Restraining Device	PVC coated, steel multi-strand cable and mounting hardware
Valve	Full port, brass body
Elbow	Malleable iron
*Deluxe Kits Include	The Dormont Blue Hose, valve, restraining device, elbows, SnapFast, display box

Specifications

The Dormont Blue Hose®

Tubing	Annealed, 304 stainless steel
Braiding	Multi-strand, stainless steel wire
Coating	Blue antimicrobial PVC, melts at 350°F (177°C); coating will not hold a flame
End Fittings	Carbon steel; zinc trivalent chromate
Stress Guard®	360° rotational end fitting at both ends

Safety System™ The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. The Safety System consists of the famous Dormont Blue Hose and a variety of accessories designed for improved safety and performance in commercial kitchens. Because they are manufactured in the USA under an ISO qualified production process and to multiple design certifications, you can Connect with Confidence with the Dormont Safety System.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

Dormont product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Dormont Technical Service. Dormont reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Dormont products previously or subsequently sold. Refer to the owner's manual for warranty information.

Dormont® A WATTS Brand

Approvals & Certifications

NSF/ANSI 169 – Special-purpose food equipment and devices
ANSI Z21.69 / CSA 6.16 – Connectors for moveable gas appliances
ANSI Z21.41 / CSA 6.9 – Quick-disconnect devices for use with gas fuel appliances
ANSI Z21.15 / CSA 9.1 – Manually operated gas valves for appliances, appliance connectors
Meets requirements of ANSI Z223.1 / NFPA 54 National Fuel Gas Code
Not for use in temperatures less than 32°F (0°C). For indoor use only.
Max operating pressure 1/2 psi.
Refer to the catalog for additional approvals and certifications or go to www.dormont.com.
A restraining device is required for all moveable gas equipment.

SnapFast® Quick-Disconnect Deluxe Kit Assembly

Ordering Information

CONFIGURATION	SIZE I.D.	24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
Deluxe Kit*	½"	1650KIT24	1650KIT36	1650KIT48	1650KIT60	1650KIT72
Basic Kit**		1650BPQR24	1650BPQR36	1650BPQR48	1650BPQR60	1650BPQR72
Hose Assembly***		1650BPQ24	1650BPQ36	1650BPQ48	1650BPQ60	1650BPQ72
Deluxe Kit*	¾"	1675KIT24	1675KIT36	1675KIT48	1675KIT60	1675KIT72
Basic Kit**		1675BPQR24	1675BPQR36	1675BPQR48	1675BPQR60	1675BPQR72
Hose Assembly***		1675BPQ24	1675BPQ36	1675BPQ48	1675BPQ60	1675BPQ72
Deluxe Kit*	1"	16100KIT24	16100KIT36	16100KIT48	16100KIT60	16100KIT72
Basic Kit**		16100BPQR24	16100BPQR36	16100BPQR48	16100BPQR60	16100BPQR72
Hose Assembly***		16100BPQ24	16100BPQ36	16100BPQ48	16100BPQ60	16100BPQ72
Deluxe Kit*	1¼"	16125KIT24	16125KIT36	16125KIT48	16125KIT60	16125KIT72
Basic Kit**		16125BPQR24	16125BPQR36	16125BPQR48	16125BPQR60	16125BPQR72
Hose Assembly***		16125BPQ24	16125BPQ36	16125BPQ48	16125BPQ60	16125BPQ72

BTU/hr Flow Capacity Natural Gas

(Flow rating BTU/hr 0.64 SP. GR. @ 0.5 inch WC pressure drop)

		LENGTH				
MODEL	SIZE I.D.	24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
1650BPQ	½"	87,000	77,000	68,000	60,000	55,000
1675BPQ	¾"	232,000	218,000	180,000	158,000	139,000
16100BPQ	1"	414,000	379,000	334,000	294,000	279,000
16125BPQ	1¼"	699,000	615,000	541,000	476,000	419,000

*** Deluxe Kits include:** The Dormont Blue Hose and restraining device, full port valve and (2) street elbows
****Basic Kits include:** The Dormont Blue Hose and restraining device, street elbow and SnapFast
*****Hose Assemblies include:** The Dormont Blue Hose, SnapFast and street elbow

Typical Installation



Options

The Dormont Blue Hose®

The Dormont Blue Hose is a commercial, moveable-grade gas connector designed for use with moveable equipment.

Moveable equipment is defined in ANSI Standard Z21.69/CSA 6.16 as gas utilization equipment that may be mounted on casters or otherwise be subject to movement.



SnapFast



- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



Restraining Device

- ANSI Z21.69 Standard section 1.7.4 states: Connectors when used on caster-mounted equipment shall be installed with a restraining device, which prevents transmission of the strain to the connector

Safety-Set®



Benefits

- Can be used with all caster-mounted equipment including cooking appliances, warming carts, salad bars, and refrigerators
- Crush Resistant
- Resistant to oils and greases
- Open-floor design allows appliance to rest level on the floor to ensure even cooking

Features

- Compatible with 4", 5", and 6" casters
- Certified to NSF/ANSI Standard 169 – Special Purpose Food Equipment & Devices
- Flexible, tough injection molded Thermoplastic Polyurethane (TPU)
- Able to withstand 1,000 PSI of crush pressure

Ordering Instructions:

The Saftey-Set wheel positioning product can be ordered individually or with the Blue Hose Kit.

The Safety-Set model name is "PS" and the ordering number is 0241002.

When ordering the Safety-Set with the Blue Hose kit, simply add the letters "PS" to the end of the model number.

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

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Item # _____ C.S.I. Section 11420

RANGES

36RB
36" HEAVY DUTY GAS SALAMANDER BROILER



Model 36RB

☐ **36RB-N** Natural Gas
☐ **36RB-P** Propane Gas

NOTE: 36RB may be used in conjunction with appropriate reinforced range back riser, wall mounted with optional brackets or counter mounted with optional 4" legs.

STANDARD FEATURES

- Stainless steel front, top and sides.
- Dual heat controls for zone cooking.
- Six 8,300 BTU cast iron burners with stainless steel radiants. 50,000 BTU/hr. total input.
- Standing pilot ignition system.
- Cool-to-the-touch knob on lever provides positive positioning of the broiler carriage (6 positions).
- Heavy-duty chrome plated grid (27½"w x 13"d).
- Removable full width spillage pan.
- ¾" top gas connection and gas pressure regulator.
- One year parts and labor warranty.

OPTIONS

☐ Set of wall mount brackets.
☐ Set of 4" legs with adjustable feet.
☐ Stainless steel reinforced back riser for range mounting.
☐ Range inter-plumb kit.
☐ Stainless steel back panel.

SPECIFICATIONS

Gas salamander broiler, Vulcan Model No. 36RB. Stainless steel front, top and sides. Six 8,300 BTU/hr. cast iron burners with stainless steel radiants; 50,000 BTU/hr. total input. Dual heat controls with improved temperature control (250°F-800°F at rack). Pilot ignition system. Cool-to-the-touch knob on lever provides positive positioning of the broiling carriage. Heavy-duty chrome plated broiling grid measures 27½"w x 13"d. Removable full width spillage pan. ¾" top gas connection and gas pressure regulator.

Exterior Dimensions:
36"w x 19"d x 17⅝"h.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 3,999 FT.

a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

RANGES

36RB
36" HEAVY DUTY GAS SALAMANDER BROILER

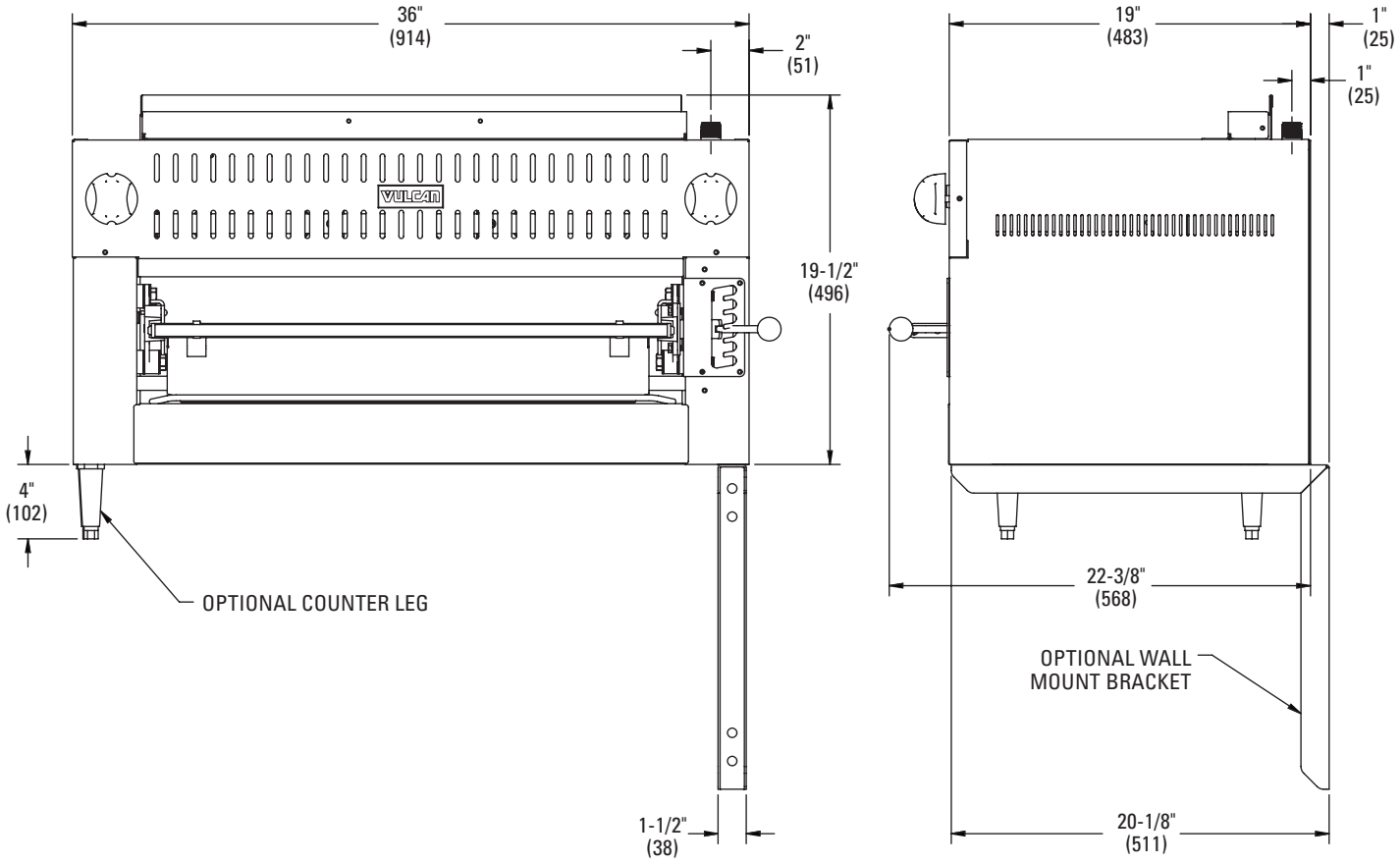
INSTALLATION REQUIREMENTS:

1. A gas pressure regulator sized for this unit is included. Natural gas 5" W.C., Propane gas 10" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169. When writing refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

   NOTE: In the Commonwealth of Massachusetts
   All gas appliances vented through a ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.
4. Clearances:

	Combustible	Non-Combustible
Rear	0"	0"
Sides	6"	0"
Bottom	10"	4"

5. This appliance is manufactured for commercial installation only and is not intended for home use.



GAS CONNECTION: ¾" (19 mm)

MODEL	INPUT BTU/hr.	WIDTH	DEPTH	HEIGHT	APPROX. SHIP. WT.
36RB	50,000	36" (914 mm)	19" (483 mm)	See Drawing	180 lbs./82 kg

Mounting of salamander requires purchase of correct reinforced riser or reinforced shelf

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

ES-D-SnapFastQD

Engineering Specification

Job Name _____ Contractor _____
Job Location _____ Approval _____
Engineer _____ Contractor's P.O. No. _____
Approval _____ Representative _____
SKU _____

SnapFast® Quick-Disconnect Assemblies

Sizes: ½" to 1¼"

SnapFast Quick-Disconnect Assemblies feature flexible movement and the one-handed quick-disconnect fitting with a unique thermal shut-off design that automatically shuts off the gas when the internal temperature exceeds 350°F (177°C).



Features

SnapFast® One-Handed Quick-Disconnect

Quick-Disconnect	Brass body, aluminum collar
Thermal Shut-off	Shuts off gas when internal temperatures exceed 350°F (177°C)

Additional Components

Restraining Device	PVC coated, steel multi-strand cable and mounting hardware
Valve	Full port, brass body
Elbow	Malleable iron
*Deluxe Kits Include	The Dormont Blue Hose, valve, restraining device, elbows, SnapFast, display box

Specifications

The Dormont Blue Hose®

Tubing	Annealed, 304 stainless steel
Braiding	Multi-strand, stainless steel wire
Coating	Blue antimicrobial PVC, melts at 350°F (177°C); coating will not hold a flame
End Fittings	Carbon steel; zinc trivalent chromate
Stress Guard®	360° rotational end fitting at both ends

Safety System™ The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. The Safety System consists of the famous Dormont Blue Hose and a variety of accessories designed for improved safety and performance in commercial kitchens. Because they are manufactured in the USA under an ISO qualified production process and to multiple design certifications, you can Connect with Confidence with the Dormont Safety System.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

Dormont product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Dormont Technical Service. Dormont reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Dormont products previously or subsequently sold. Refer to the owner's manual for warranty information.

Dormont® A WATTS Brand

Approvals & Certifications

NSF/ANSI 169 – Special-purpose food equipment and devices
ANSI Z21.69 / CSA 6.16 – Connectors for moveable gas appliances
ANSI Z21.41 / CSA 6.9 – Quick-disconnect devices for use with gas fuel appliances
ANSI Z21.15 / CSA 9.1 – Manually operated gas valves for appliances, appliance connectors
Meets requirements of ANSI Z223.1 / NFPA 54 National Fuel Gas Code
Not for use in temperatures less than 32°F (0°C). For indoor use only.
Max operating pressure 1/2 psi.
Refer to the catalog for additional approvals and certifications or go to www.dormont.com.
A restraining device is required for all moveable gas equipment.

SnapFast® Quick-Disconnect Deluxe Kit Assembly

Ordering Information

CONFIGURATION	SIZE I.D.	24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
Deluxe Kit*	½"	1650KIT24	1650KIT36	1650KIT48	1650KIT60	1650KIT72
Basic Kit**		1650BPQR24	1650BPQR36	1650BPQR48	1650BPQR60	1650BPQR72
Hose Assembly***		1650BPQ24	1650BPQ36	1650BPQ48	1650BPQ60	1650BPQ72
Deluxe Kit*	¾"	1675KIT24	1675KIT36	1675KIT48	1675KIT60	1675KIT72
Basic Kit**		1675BPQR24	1675BPQR36	1675BPQR48	1675BPQR60	1675BPQR72
Hose Assembly***		1675BPQ24	1675BPQ36	1675BPQ48	1675BPQ60	1675BPQ72
Deluxe Kit*	1"	16100KIT24	16100KIT36	16100KIT48	16100KIT60	16100KIT72
Basic Kit**		16100BPQR24	16100BPQR36	16100BPQR48	16100BPQR60	16100BPQR72
Hose Assembly***		16100BPQ24	16100BPQ36	16100BPQ48	16100BPQ60	16100BPQ72
Deluxe Kit*	1¼"	16125KIT24	16125KIT36	16125KIT48	16125KIT60	16125KIT72
Basic Kit**		16125BPQR24	16125BPQR36	16125BPQR48	16125BPQR60	16125BPQR72
Hose Assembly***		16125BPQ24	16125BPQ36	16125BPQ48	16125BPQ60	16125BPQ72

BTU/hr Flow Capacity Natural Gas

(Flow rating BTU/hr 0.64 SP. GR. @ 0.5 inch WC pressure drop)

		LENGTH				
MODEL	SIZE I.D.	24" (607MM)	36" (914MM)	48" (1,219MM)	60" (1,524MM)	72" (1,829MM)
1650BPQ	½"	87,000	77,000	68,000	60,000	55,000
1675BPQ	¾"	232,000	218,000	180,000	158,000	139,000
16100BPQ	1"	414,000	379,000	334,000	294,000	279,000
16125BPQ	1¼"	699,000	615,000	541,000	476,000	419,000

*** Deluxe Kits include:** The Dormont Blue Hose and restraining device, full port valve and (2) street elbows
****Basic Kits include:** The Dormont Blue Hose and restraining device, street elbow and SnapFast
*****Hose Assemblies include:** The Dormont Blue Hose, SnapFast and street elbow

Typical Installation



Options

The Dormont Blue Hose®



The Dormont Blue Hose is a commercial, moveable-grade gas connector designed for use with moveable equipment.

Moveable equipment is defined in ANSI Standard Z21.69/CSA 6.16 as gas utilization equipment that may be mounted on casters or otherwise be subject to movement.

SnapFast



- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



Restraining Device

- ANSI Z21.69 Standard section 1.7.4 states: Connectors when used on caster-mounted equipment shall be installed with a restraining device, which prevents transmission of the strain to the connector

Safety-Set®



Benefits

- Can be used with all caster-mounted equipment including cooking appliances, warming carts, salad bars, and refrigerators
- Crush Resistant
- Resistant to oils and greases
- Open-floor design allows appliance to rest level on the floor to ensure even cooking

Features

- Compatible with 4", 5", and 6" casters
- Certified to NSF/ANSI Standard 169 – Special Purpose Food Equipment & Devices
- Flexible, tough injection molded Thermoplastic Polyurethane (TPU)
- Able to withstand 1,000 PSI of crush pressure

Ordering Instructions:

The Saftey-Set wheel positioning product can be ordered individually or with the Blue Hose Kit.

The Safety-Set model name is "PS" and the ordering number is 0241002.

When ordering the Safety-Set with the Blue Hose kit, simply add the letters "PS" to the end of the model number.

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

Dormont®
A WATTS Brand

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ES-D-SnapFastQD 2110

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Datasheet

iCombi® Pro 10-half size E/G



Capacity
> Ten (10) Half-size sheet pans or Ten (10) Steam table pans or Ten (10) 1/1 GN accessories
> Removable standard hinging rack with 2 5/8 inch rack spacing (68 mm)
> Large selection of accessories for various cooking procedures, such as grilling, braising or baking
> For use with 1/1, 1/2, 2/3, 1/3 GN accessories

Combi-steamer mode
> Steaming 86 °F - 266 °F
> Convection 86 °F – 572 °F
> Combination of steam and convection 86 °F – 572 °F

Description
Intelligent, connectable cooking system with the operating modes poultry, meat, fish, egg dishes/desserts, side dishes/vegetables, baked goods and finishing as well as the cooking methods roasting, cooking, baking and grilling.
> Combi steamer as per DIN 18866 (in manual mode).
> For most cooking processes used in commercial kitchens.
> For using steam and convection, individually, one after the other, or combined.

Ventilation approvals: The electrical appliance conforms to the EPA 202 test in accordance with ANSI/NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations" Refer to UL Listing KNLZ.E148536 (America) or KNLZ7.E148536 (Canada).
The following intelligent assistants are available:

Intelligent assistant
iDensityControl iProductionManager iCookingSuite iCareSystem

iDensityControl
iDensityControl is the iCombi Pro's intelligent climate management. The interaction among intelligent sensors, a high-performance heating system and fresh steam generator, and active dehumidification ensures that the right cooking cabinet climate is always available. Intelligent air circulation ensures the best possible energy input into the food. Consequently, this ensures extraordinary productivity while maintaining high levels of food quality, even cooking and minimum energy consumption.

iCookingSuite
The iCookingSuite is the iCombi Pro's cooking intelligence. The user starts by selecting the right cooking path for the food, choosing from among 6 operating modes and / or 5 cooking methods. Users also specify the desired cooking result. The unit suggests settings for browning and degree of doneness. Intelligent sensors detect the size, quantity and condition of the food. While the cooking path is in progress, the system adjusts key parameters like cooking cabinet temperature, airspeed, and cooking time accurately to the second. The selected desired results are achieved, yielding the best possible quality in the shortest possible time. It is possible to optionally influence the cooking sequence and adapt the cooking result. Users can change to iProductionManager or manual mode at any time. Thanks to iCookingSuite you can simply save time, raw materials, and energy while maintaining a standardized food quality without having to check the procedure.

iProductionManager
iProductionManager intelligently and flexibly organizes the production process. This includes which products can be prepared together on different trays, the ideal sequence of dishes, and monitoring the cooking sequence. iProductionManager supports users with prompts to load or unload dishes. Depending on kitchen processes you can freely position orders (up to two per level) or schedule them on the basis of a certain target time. iProductionManager arranges the sequence of dishes accordingly and automatically specifies the correct settings. Users decide whether dishes are cooked based on optimum energy consumption or a certain target time. Simple monitoring activities are no longer required, saving you working time and energy.

iCareSystem
The iCareSystem is the intelligent iCombi Pro cleaning and descaling system. It recommends the amount of chemicals and ideal cleaning stage from the nine available programs based on usage and any limescale in the steam generator. Ultra-fast interim cleaning cleans iCombi Pro in only 12 minutes, all cleaning programs can also run overnight without the need for supervision. The iCareSystem is particularly efficient and environmentally friendly, consuming small quantities of phosphate-free care products, water, and energy. This means that the iCombi Pro is always hygienically clean without manual work and at minimal costs.

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Unit description and functions

Intelligent functions
> Intelligent climate management that measures, adjusts and controls the humidity down to the exact percentage
> The actual measured humidity in the cooking cabinet can be adjusted and viewed
> Dynamic air turbulence in the cooking cabinet thanks to two intelligent, reversible, high-performance fan wheels with five fan wheel speeds, intelligently actuated and manually programmable
> Intelligent cooking path regulation and automatic adjustment of cooking steps in order to achieve the target results, e.g., browning and degree of doneness, safely and efficiently - regardless of product size, load quantity, or who is using the unit
> Monitoring accurate to the second and calculation of browning on the basis of the Maillard reaction to reproduce ideal cooking results
> Adjust intelligent cooking methods or switch between iCookingSuite and iProductionManager for maximum flexibility
> Intelligent cooking step to proof baked goods
> Individual, intuitive programming of up to 1,200 cooking programs with up to 12 steps using drag-and-drop.
> Easy transfer of cooking programs to other cooking systems through secure cloud connection with ConnectedCooking or via USB stick
> iProductionManager, the automated, intelligent planning and controlling tool, organizes multiple cooking processes and mixed loads perfectly. Automatic closing of planning gaps. Automatically optimize schedules and energy consumption in planning and target time preparation to start or end cooking dishes at the same time.
> Visual indication of loading and removal requests using energy-saving LED lighting
> Automatically resumes and optimally completes cooking processes following power outages lasting less than 15 minutes
> Intelligent cleaning system suggests cleaning programs and the required amount of care products based on the degree of soiling within the cooking system
> Display of the current cleaning and descaling status
> Condensation/exhaust air hoods (accessories) with situational adjustment of the extraction performance and transfer of service messages.

Cooking functions
> High-performance steam generator for optimal steaming performance even at low temperatures below 212°F
> Power-steam function: increased steaming power available for Asian applications
> Integrated, maintenance-free grease separation system without an additional grease filter
> Cool-down function to quickly cool down the cooking cabinet; additional fast cooling using internal water nozzle
> Core temperature probe with six measuring points and automatic error correction in the event of incorrect positioning. Optional positioning tool for soft or very small cooking products (accessory)
> Delta-T cooking for extremely gentle preparation with minimal cooking losses
> Precise burst-steam injection; water quantities can be set to 4 different levels within a temperature range of 85°F – 500°F for convection or steam-convection combination modes
> Digital temperature display, can be set to °C or °F, displays target and actual values
> Cooking cabinet humidity and time displayed digitally; displays target and actual values
> Time can be set to display in 12- or 24-hour format
> 24-hour real-time clock with automatic adjustment for daylight savings time when connected to ConnectedCooking
> Automatic pre-selected starting time with variable date and time
> Integrated hand shower with automatic retraction and switchable spray/jet function
> Energy-saving, long-lasting LED lighting in the cooking cabinet, with excellent color fidelity to allow quick determination of cooking progress
> No-charge 4-hour RATIONAL certified chef assistance program

Occupational and operating safety
> Electronic safety temperature limiter for steam generator and convection heating
> Integrated fan wheel brake
> Contact temperature of the cooking cabinet door max. 163 °F
> Use of Active Green cleaning tabs and Care tabs (solid cleaning agent) for ideal occupational safety levels
> HACCP data storage and output via USB or optional storage and management in the cloud-based networking solution ConnectedCooking
> Tested according to national and international standards for unsupervised operation
> Maximum tray height must not exceed 63 inch when using a RATIONAL stand
> Ergonomic door handle with right- / left-handed door opening and swing-shut function

Networking
> Integrated, IP-protected Ethernet interface for wired connection to the cloud-based ConnectedCooking networking solution
> Integrated Wi-Fi interface for wireless connection to the cloud-based networking solution ConnectedCooking
> Integrated USB interface for local data exchange
> Cloud-based ConnectedCooking solution allows central unit management; recipe, shopping cart and program management; HACCP data management; maintenance management

Cleaning and care
> Automatic, water pressure-independent cleaning and maintenance system for cooking cabinet and steam generator
> Nine cleaning programs for unsupervised cleaning, also overnight, with automatic cleaning and removal of limescale deposits within the steam generator
> Ultrafast cleaning in only 12 minutes for practically uninterrupted, hygienic production
> Automatic cleaning routine following power outages, ensuring that cooking cabinet remains free of cleaning agents even after the cleaning process has been canceled
> Use of phosphate and phosphorus-free Active-Green cleaning agent tabs and Care tabs
> Hygienic setup that is flush with the counter without feet for simple, safe cleaning

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> Triple glass pane cooking cabinet door with rear ventilation, thermally reflecting special coating and swiveling glass panes for easy cleaning
> Inside and outside material: stainless steel DIN 1.4301 / ASTM 304, seamless hygienic cooking cabinet with rounded corners and optimized air flow
> Glass and stainless steel surfaces allow easy, safe external cleaning; IPX5-class protection against spraying water in all directions
> Monitoring option for automatic cleaning using the cloud-based ConnectedCooking networking solution

Operation

> High-resolution 10.1 inch TFT color display and capacitative touchscreen with self-explanatory icons for simple, intuitive operation with gestures like swiping and dragging
> Acoustic prompts and visual messages when user action is required
> Central dial with Push function for intuitive selection and confirmation of entries
> User interface and help function can be set to over 55 languages
> Basic national cuisine preferences can be selected regardless of language settings. Possible to select additional, local cuisine
> Specially adapted cooking parameters for international or country-specific dishes can be selected and started regardless of unit language settings
> Extensive search function including all cooking paths, application examples and settings
> Context-sensitive support that always shows the current help content for the displayed screen content
> Start application examples from help file
> Simple selection of cooking paths using six operating modes and/or five cooking methods
> Cockpit function to display information about the processes within a cooking path
> Customization and control of user profiles to prevent operator errors
> Interactive notifications regarding cooking paths, requested actions, intelligent functions and warnings thanks to Messenger

Installation, maintenance and environment

> Professional installation by RATIONAL-certified technicians recommended
> Fixed waste water connection conforming to SVGW requirements is permitted
> Adaptation to the installation site (height above sea level) through automatic calibration
> Operation without water softener and without additional manual descaling possible
> Installation flush with the floor and wall through connection in the base area *
> Service diagnostic system with automatic service message display, self-test function for active testing of unit functions
> Remote diagnosis via ConnectedCooking by certified RATIONAL service partners
> 2-year RATIONAL warranty including parts, labor, and travel and 5-year steam generator warranty**
> Regular maintenance is recommended. Servicing by RATIONAL service partner according to manufacturer recommendations
> Energy efficiency in accordance with ENERGY STAR tested and passed. Published at www.energystar.gov

* See the installation or planner manual for details

** Terms and conditions apply, see manufacturer warranty statement at www.rational-online.com

Options

> Cooking cabinet door, left-hinged
> MarineLine - marine version
> SecurityLine – prison / security version
> MobilityLine – mobile variant
> HeavyDutyLine – particularly heavy-duty version
> Integrated fat drain
> Mobile oven rack package
> Protection for control panel
> Safety door lock
> Lockable control panel

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Technical specifications

Dimensions and weights

Dimensions (W x H x D)	
Cooking system (body)	33 1/2 x 39 7/8 x 30 1/2 inches
Cooking system (total)	33 1/2 x 41 7/8 x 33 1/8 inches
Cooking system with packaging	36 3/4 x 49 1/4 x 37 5/8 inches
Maximum working height of top level*	≤ 5 ft. 2 7/8 inches

*when using a corresponding RATIONAL stand

Weights	
Maximum load size per level	33 lb
Maximum total load capacity	99 lb
Weight - electric unit without packaging	279 lb
Weight - electric unit with packaging	324 lb
Weight - gas unit without packaging	341 lb
Weight - gas unit with packaging	385 lb

Electrical connection conditions

Voltage 3 AC 208 V /240V	
Connected loads - electric	18.9 kW
Steam power	18 kW
Convection power	18 kW
Breaker	60 A
RCD type	B
Cable diameter	AWG 4 140°F
Voltage 3 AC 440 V / 480 V	
Connected loads - electric	18.9 kW
Steam power	18 kW
Convection power	18 kW
Breaker	30 A
RCD type	B
Cable diameter	AWG 8 140°F

Connected loads - gas

Natural gas G20	
Nominal heat load, total	83500 BTU
Nominal heat load, Steam mode	76000 BTU
Nominal heat load, Hot Air mode	83500 BTU
Required connection flow pressure	6.5 – 10 inch w.c.
Liquid gas	
Nominal heat load, total	82000 BTU
Nominal heat load, Steam mode	74500 BTU
Nominal heat load, Hot Air mode	82000 BTU
Required connection flow pressure	10 – 15 inch w.c.

3/4" NPT with 3/4" gas shut off
Additional gas types and voltages available on request

Connected loads - gas

Voltage 2 AC 208 V	
Connected loads - gas	0.9 kW
Breaker	15 A
RCD Type	B
Voltage 1 NAC 120 V	
Connected loads - gas	0.9 kW
Breaker	15 A
RCD Type	B

Connection conditions water

Water inlet (pressure hose), each	3/4"
Water pressure (flow pressure), each	14.5-87.0 psi
Water drain, each	2" OD
Maximum flow rate per cooking system	3.17 gal/min

Water quality requirements

Untreated water can be 0 to 24.5 gr/gal (0 to 420ppm) hardness. We do not recommend treated water hardness < 5 gr/gal (86ppm) because the water could be corrosive. Sodium ion exchangers are not recommended; H+ Ion exchange systems are recommended. Water that does not meet the following minimum standards will require the proper conditioning

Contaminant	Water Requirements	If > than recommended
Sand / Particles	< 15 µm	Particle filter
Chlorine (Cl2)	< 0.12 gr/gal (0.2 ppm)	Active carbon filter
Chloride (Cl-)	< 4.68 gr/gal (80 ppm)	RO

Connected loads - exhaust air and thermal load

Latent heat load	3269 BTU
Sensible heat emission	4344 BTU
Sound level (electric)	55 dBA
Sound level (gas)	60 dBA

Connection loads - data

LAN data interface	RJ45
WiFi data interface	IEEE 802.11 a/g/n

Minimum distances at installation

Clearance Requirements
To facilitate servicing, we recommend leaving a 20" (500 mm) gap on the left-hand side of the unit. If there is not 20" (500 mm) left side clearance available, provisions for moving the unit to the left for service access must be made. Such provisions include, but are not limited to, having quick connections (water, gas, etc.) and lengthened electrical connections with flexible cords.
If there are no external heat sources acting on the unit, there should be at least 2" (50 mm) of clearance on either side of the unit. The back of the unit can be mounted flush with the wall.
If a high temperature heat source is on the left side of the unit, clearance of at least 14" (350 mm) must be maintained on the left-hand side. This clearance may be reduced to 2" (50 mm) if a heat shield is used (see accessories).
Recommended clearance from unobstructed rear exhaust pipes and any surface collecting grease or flammable material; 16" (400 mm) gas, 10" (254 mm) electric. It is recommended to have a hood overhang of 6" (150 mm) to 18" (450 mm) at the front of the unit and 6" (150 mm) on the sides if installed at the end of the cooking line. Please refer to the Installation Manual for additional technical data and for instructions on installation and setup.

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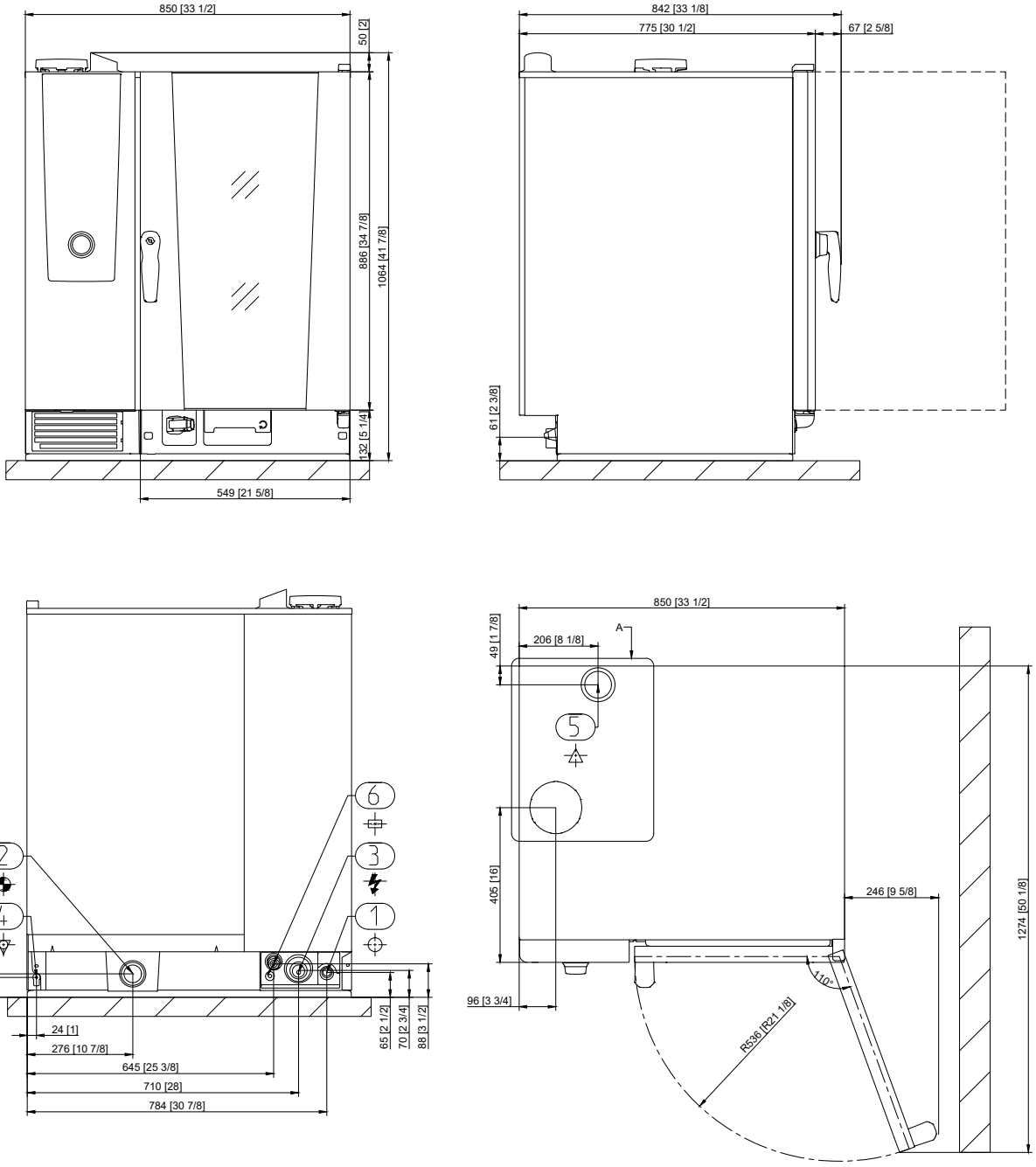
Terms and conditions of installation

> Observe all local and country-specific standards and regulations regarding the installation and operation of industrial cooking appliances. The local standards and regulations for interior ventilation systems must also be taken into account.
> To use ConnectedCooking, an RJ45 network socket or a WLAN connection option (IEEE 802.11 a/g/n) must be in place on-site. For optimal performance, a data rate of at least 100 MB/s is required.

Approvals

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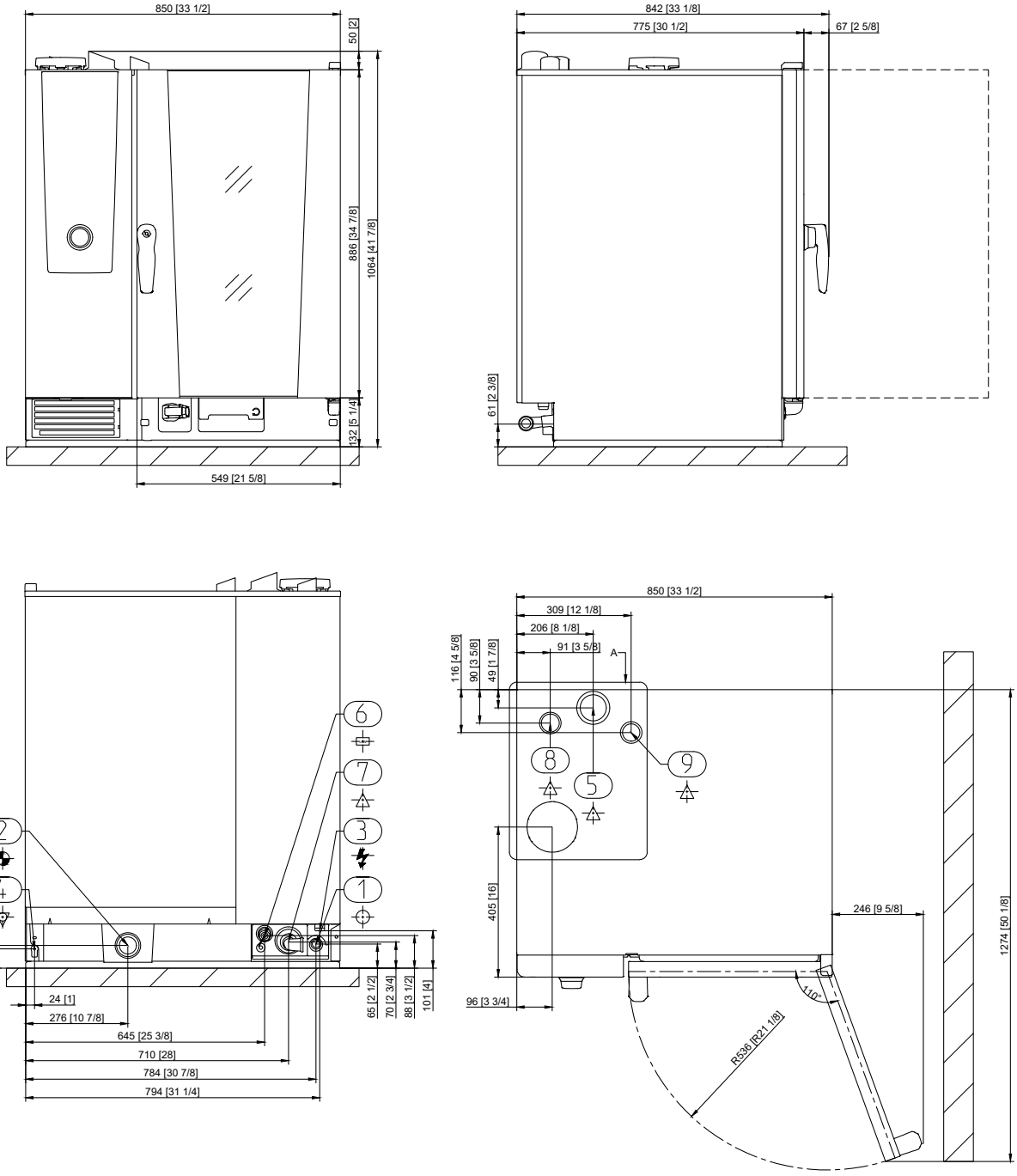
Technical drawing, electrical



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface

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Technical drawing, gas



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface
7	Gas connection
8	Exhaust pipe gas (steam)
9	Exhaust pipe gas (convection)

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Accessories

Accessories	Item number
RATIONAL Active Green cleaning agent tabs – guarantee the best cleaning performance	Item no. 56.01.535
RATIONAL Care tabs – effectively prevent limescale deposits	Item no. 56.00.562
Stands are available in various versions - standard, with casters, or with anchorable stainless steel feet	See Cooking Systems and Accessories catalog
Run-in rail for mobile rack and mobile plate rack Size 6-half size, 10-half size	Item no. 60.75.115
Condensation breaker – diverts steam and vapors to an existing exhaust air system Sizes 6-half size, 10-half size, 6-full size and 10-full size	Item no. 60.72.592
RATIONAL USB stick – to securely transfer cooking programs and HACCP data	Item no. 42.00.162
Finishing system for banquets Size 10-half size, 26 plates	Item no. 60.11.629
Finishing system for banquets Size 10-half size, 32 plates	Item no. 60.11.628
Hinging racks – Size 10-half size	Item no. 8 racks 60.11.547
Heat shield – for installing a unit near a heat source, e.g. a grill - Size 10-half size	Item no. left side 60.75.773 Item no. right side 60.75.771
Mobile catering stand - especially for heavy mobile catering usage	Item no. 60.31.164
Mobile oven rack and mobile plate oven rack – for simple loading outside the cooking system	See Cooking Systems and Accessories catalog
Transport trolley for mobile rack and mobile plate rack - height-adjustable - Sizes 6-full size, 10-full size	Item no. 60.75.606
Transport trolley for mobile rack and mobile plate rack - standard - Sizes 6-half size, 10-half size	Item no. 60.74.000
UltraVent recirculating hood - for Size 6-half size, 10-half size electric units only	Item no. 60.67.179
UltraVent Plus recirculating hood - for Size 6-half size, 10-half size electric units only	Item no. 60.76.177
Stackable Combi-Duo kit Size 6-half size E/G on Size 6-half size E or Size 10-half size E	Item no. 60.73.991
RATIONAL Single Water Filter - for all single models and Combi-Duo XS/XS, 6-half size/6-half size and 6-half size/10-half size	Item no. 1900.1154US

We offer a wide range of cooking accessories to help you achieve ideal cooking results; for more information, please consult our accessories brochure, ask your dealer, or visit www.rational-online.com

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Planner	RATIONAL USA Inc.
	1701 Golf Road, Suite C-120, Commercium Rolling Meadows, IL 60008 Toll Free: 888-320-7274 Fax: 847-755-9583 Email: info@rational-online.com Visit us on the internet: www.rational-online.com

Installation Information Form.

To ensure maximum customer satisfaction and proper future service support.
Dealer is responsible for completing this form.

Submit this form with every PO.

Project Name (required)

Phone Number Project Location (required)

Street Address (required)

City/State/Zip Code (required)

Location Contact Name (required)

Phone Number Location Contact (required)

Location Contact Email (required)

RATIONAL PO Number

Please select one of the options below.

- ☐ This PO includes a Pre-Installation Site Consultation and/or RATIONAL Certified Installation(RCI). Commissioning is included with RCI. Commissioning that can not be completed at the time of installation can incur additional costs.
- ☐ This PO includes Commissioning. RSP information will be emailed to Signee & Location Contact. They are responsible to contact RSP to schedule the Commissioning visit after the installation is completed. Commissioning that can not be completed due to improper installations can incur additional costs
- ☐ Installation and/or Commissioning will be purchased directly from a RATIONAL Service Partner.
- ☐ Installation and/or Commissioning by a RATIONAL Service Partner is **declined**. An Installation Manual is delivered with every RATIONAL unit. RATIONAL will not warranty service calls related to improper installation. All gas units must be calibrated via a flue gas analysis.

☐ New Construction	Approximate Pre-Installation Site Consultation Date (If Purchased):
☐ Replacement	Approximate Installation Date:

Dealer:

Contact at Dealer:

Phone Number:

Email:

Signature:

Date:

The ship date will be the date indicated on the sales confirmation. This date may be subject to change.

1701 Golf Road Suite C-120, Commercium Rolling Meadows, IL 60008
Phone (224) 366-3500 Fax (847) 755-9583

21736 · V-01 · DP/Ad · 06/22 · en_US

Installation Kit
Article no. 8720.1560US

The RATIONAL Installation Kit ensures that the installer has all the essential connection materials on hand at the time of install. Not all parts are used in every installation.

Gas RATIONAL Combi Oven 6-half size G (120v/60/1ph) or (208v/60/1ph)
Gas RATIONAL Combi Oven 10-half size G (120v/60/1ph) or (208v/60/1ph)
Gas RATIONAL Combi Oven 6-full size (208-240v/60/1ph)

The Installation Kit for the above models includes:

1	ea	Gas Connector Hose, 3/4" NPT connection, 48" long, stainless steel braid with Plastic coat exterior, brass push to connect quick disconnect coupling, for castered equipment with cable strain relief
1	ea	90 degree black iron elbows, 3/4" NPT
2	ea	90 degree black iron street elbows, 1" NPT
1	ea	18" long × 3/4" NPT black iron pipe
1	ea	10" long × 3/4" NPT black iron pipe
1	ea	8" long × 3/4" NPT black iron pipe
1	ea	Close nipple 3/4" NPT black iron pipe
2	ea	45 degree black iron elbows, 3/4" NPT
2	ea	2" Minnies
1	ea	3/4" minnies
2	ea	3/4" Water Connector Hose, 5/8" ID, 3/4" female hose thread both ends, 60" long rubber coated, NSF approved
1	ea	Male union 3/4" × 3/4" MHT
2	ea	90 deg Fresh water elbow
8	feet	2" copper pipe (two 4' pieces)
2	ea	2" copper pipe 90 degree elbow
1	ea	2" copper pipe T fitting
2	ea	2" copper pipe 45 degree elbow
1	ea	2" copper pipe 90 degree elbow female to male
1	ea	2" copper pipe 90 degree long sweep
1	ea	2" copper pipe coupling
1	ea	Receptacle NEMA 6-15R 15A-250V
1	ea	NEMA 6-15R cover plate single junction box
1	ea	NEMA 6-15P
1	ea	NEMA 5-15P

Please note that installation kits are non-discountable.

8720.1560US · V-01 · MDS/Leno · 11/25 · en_US

Water Filtration Products.

R195-CL



R195-CL

RATIONAL Water Filtration Products Model R195-CL single cartridge water filtration system helps provide consistent high quality water for your RATIONAL combi by reducing the effects of sediment, chloramines, chlorine, taste & odor while providing the required flow rates for any single Combi model or Combi-Duo models 6-half size/6-half size or 6-half size/10-half size or XS/XS.

Product Benefits

- Carbon block technology effectively reduces chloramines, chlorine, taste, and odor for better equipment protection.
- NSF Standard 42 and FDA CFR-21 compliant materials.
- Sanitary Quick Change (SQC) encapsulated cartridge design allows for fast and easy cartridge change-outs with ¼" turn.
- ½" FNPT horizontal inlet and outlet ports allow direct or easily adaptable connections to existing plumbing lines.

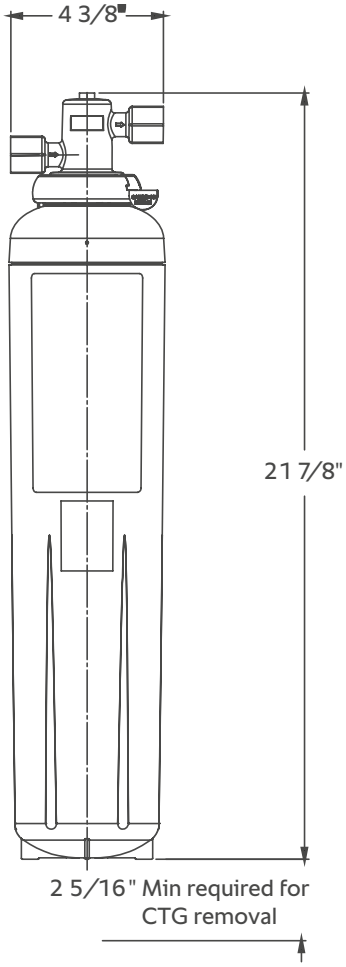
Model Number	Article No.	Reduction Claims	Nominal Micron Rating	Capacity	Service Flow Rate	Replacement Cartridge
R195-CL	1900.1154US	Sediment, Chloramines [1], Chlorine, Taste and Odor	5.0 [2]	30,000 gallons (113,550 liters)	2.5 gpm (9.5 lpm)	R95-CL 1900.1155US

1 As tested and certified by independent third party laboratory
2 NSF Certified for Particulate Reduction

Visit www.nsf.org for the claims associated with products that are NSF listed.

Water Filtration Products.

R195-CL



Application Guide

› Any single RATIONAL combi
› XS/XS Combi-Duo
› 6-half size/6-half size Combi-Duo
› 6-half size/10-half size Combi-Duo

Important: Installation Tips

These installation tips are for informational purposes only and are not intended to be used as actual installation instructions. Caution: To reduce the risk associated with property damage due to water leakage:

› Read and follow Use Instructions before installation and use of this system.
› Installation and use must comply with all state and local plumbing codes.
› Protect from freezing, remove filter cartridge when temperatures are expected to drop below 40°F (4.4°C).
› Do not install on hot water supply lines. The maximum operating water temperature of this filter system is 100°F (37.8°C).
› Do not install if water pressure exceeds 125 psi (862 kPa). If your water pressure exceeds 80 psi (552 kPa), you must install a pressure limiting valve. Contact a plumbing professional if you are uncertain how to check your water pressure.
› Do not install where water hammer conditions may occur. If water hammer conditions exist you must install a water hammer arrester. Contact a plumbing professional if you are uncertain how to check for this condition.
> The disposable filter cartridge must be replaced every 12 months, at the rated capacity or sooner if a noticeable reduction in flow rate occurs.

Warning

To reduce the risk associated with the ingestion of contaminants:
Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.

RATIONAL recommends regularly scheduled maintenance and replacement of the filter cartridge(s) in order for the product to perform as advertised/sold. RATIONAL shall not be liable for system failures due to improper maintenance.

RATIONAL USA
1701 Golf Road
Suite C-120, Commercium
Rolling Meadows, IL 60008

Tel. 888-320-7274 (Toll Free)
Fax 847-755-9583

info@rational-online.us
rationalusa.com

Limited Warranty
RATIONAL warrants this Product will be free from defects in material and manufacture for five (5) years from the date of purchase: The filter cartridge or filter membrane is warranted to be free from defects in material and manufacture for one (1) year. This warranty does not cover failures resulting from abuse, misuse, alteration or damage not caused by RATIONAL Water Filters or failure to follow installation and use instructions. No warranty is given as to the service life of any filter cartridge or membrane as it will vary with local water conditions and water consumption. RATIONAL MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOMER OR USAGE OF TRADE. If the Product fails to satisfy this Limited Warranty during the warranty period, RATIONAL will replace the Product or refund your Product purchase price. This warranty does not cover labor. The remedy stated in this paragraph is Customer's sole remedy and RATIONAL exclusive obligation. For additional information, see the entire Limited Warranty located in the product Installation and Operating Instruction Manual.
Limitation of Liability. RATIONAL will not be liable for any loss or damage arising from this RATIONAL product, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

21.055 · V-02 · MDS/Leno · 10/20 · en_US

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Oven Delimer Tablets for RATIONAL SelfCookingCenter®, Art. Nr. 56.00.560, 56.00.562

1. Identification

Product identifier

Oven Delimer Tablets for RATIONAL SelfCookingCenter®, Art. Nr. 56.00.560, 56.00.562

Recommended use of the chemical and restrictions on use

Use of the substance/mixture

Preservative agent

Details of the supplier of the safety data sheet

Company name:	Rational AG	
Street:	Iglinger Strasse 62	
Place:	D-86899 Landsberg	
Telephone:	+49 (0)8191-3270	Telefax: +49 (0)8191-21735
Responsible Department:	Responsible for the safety data sheet: reinigung@rational-online.de	

Emergency phone number: In North America contact Info Trac at 1-800-535-5053
outside USA/CA contact +49 89 19240

2. Hazard(s) identification

Classification of the chemical

Regulation (EC) No. 1272/2008

Hazard categories:
Skin corrosion/irritation: Skin Irrit. 2
Serious eye damage/eye irritation: Eye Irrit. 2
Hazard Statements:
Causes skin irritation
Causes serious eye irritation

Label elements

Regulation (EC) No. 1272/2008

Signal word: Warning

Pictograms:



Hazard statements

Causes skin irritation
Causes serious eye irritation

Precautionary statements

Keep out of reach of children.
If medical advice is needed, have product container or label at hand.
Wear protective gloves/protective clothing/eye protection/face protection.
If on skin: Wash with plenty of water.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If exposed or concerned: Get medical advice/attention.

Hazards not otherwise classified

Not known.

3. Composition/information on ingredients

Mixtures

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Hazardous components

CAS No	Components	Quantity
77-92-9	Citric acid	> 20 %
617-48-1	Malic acid	> 20 %
124-04-9	Adipic acid	1 - 5 %

4. First-aid measures

Description of first aid measures

General information

If you feel unwell, seek medical advice.

After inhalation

Move to fresh air in case of accidental inhalation of dust or fumes from overheating or combustion.

After contact with skin

In case of contact with skin wash off immediately with soap and water.
Consult a doctor if skin irritation persists.

After contact with eyes

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Seek medical treatment by eye specialist.

After ingestion

Rinse out mouth thoroughly with water.
Do not induce vomiting.
Never give anything by mouth to an unconscious person.
Summon a doctor immediately.

Most important symptoms and effects, both acute and delayed

WARNING !
Causes serious eye irritation.
Causes skin irritation.

OSHA Hazard Communication: This material is considered hazardous by the OSHA Hazard Communication Standard 29CFR 1910.1200.

Indication of any immediate medical attention and special treatment needed

Treat symptoms.

5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

Product does not burn, fire-extinguishing activities according to surrounding.

Unsuitable extinguishing media

Full water jet.

Specific hazards arising from the chemical

Fire may produce:
Irritant/corrosive, flammable as well as toxic distillation gases (carbonization gases).

Special protective equipment and precautions for fire-fighters

Use breathing apparatus with independent air supply.
Protective suit.

Additional information

Cool containers at risk with water spray jet.
Fire residues and contaminated firefighting water must be disposed of in accordance with the local regulations.

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Oven Delimer Tablets for RATIONAL SelfCookingCenter®, Art. Nr. 56.00.560, 56.00.562

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

No special precautions required.

Environmental precautions

Do not discharge into the drains/surface waters/groundwater.

Methods and material for containment and cleaning up

Pick up mechanically, avoiding dust, and provide disposal in suitable recipients.
Flush rests with sufficient amount of water.

Reference to other sections

Observe protective instructions (see Sections 7 and 8).
Information for disposal look up chapter 13.

7. Handling and storage

Precautions for safe handling

Advice on safe handling

Avoid the formation of dust.
Avoid contact with eyes, skin or mucous membrane.

Advice on protection against fire and explosion

No special protective measures against fire required.

Conditions for safe storage, including any incompatibilities

Requirements for storage rooms and vessels

Keep in the original sealed container.
Keep containers tightly closed in a dry, well-ventilated place.

Further information on storage conditions

Keep away from food, drink and animal feeding stuffs.

8. Exposure controls/personal protection

Control parameters

Exposure controls

Appropriate engineering controls

Provide appropriate exhaust ventilation at machinery and at places where dust can be generated.

Protective and hygiene measures

Avoid contact with eyes and skin.
Wash hands before breaks and at the end of workday.
When using do not eat, drink or smoke.
Remove and wash contaminated clothing before re-use.

Eye/face protection

Tightly fitting goggles.
Eye wash bottle with pure water.

Hand protection

Protective gloves resistant to chemicals made off natural-rubber latex, Minimum coat thickness 0.6 mm, Permeation resistance (wear duration) approx. 480 minutes, i.e. protective glove <Lapren 706> made by www.kcl.de.
This recommendation refers exclusively to the chemical compatibility and the lab test conforming to EN 374 carried out under lab conditions.
Requirements can vary as a function of the use. Therefore it is necessary to adhere additionally to the recommendations given by the manufacturer of protective gloves.

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Respiratory protection

No personal respiratory protective equipment normally required.
Breathing apparatus (particle filter) only if dust is formed.

9. Physical and chemical properties

Information on basic physical and chemical properties

Physical state:	Tablet
Color:	White
Odor:	Characteristic

		Test method
pH-Value:	2,5	(1%)

Changes in the physical state

Flash point:	n.a.
Lower explosion limits:	n.a.
Upper explosion limits:	
Ignition temperature:	n.a.

Oxidizing properties
n.a.

Vapor pressure: (at 20 °C)	n.a.
Water solubility: (at 20 °C)	Soluble
Partition coefficient:	n.d.

Other information

Bulk density: approx. 800 g/L

10. Stability and reactivity

Reactivity

No decomposition if stored and applied as directed.

Chemical stability

Stability: Stable

Stable under normal conditions.

Possibility of hazardous reactions

Hazardous reactions: Will not occur

No hazardous reactions known.

Conditions to avoid

Protect from moisture.

Incompatible materials

No materials to be especially mentioned.

Hazardous decomposition products

No hazardous decomposition products known.

11. Toxicological information

Information on toxicological effects

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Route(s) of Entry

Skin and eye contact, inhalation and ingestion.

Acute toxicity

Based on available data, the classification criteria are not met.
Citric acid
LD50/oral/rat: 6730 mg/kg
Adipic acid
LD50/oral/rat: 11000 mg/kg
Malic acid
LD50/oral/rat: >3200 mg/kg

CAS No	Components				
	Exposure routes	Method	Dose	Species	Source
77-92-9	Citric acid				
	oral	LD50	11700 mg/kg	Rat	
	dermal	LD50	> 2000 mg/kg	Rat	

Irritation and corrosivity

Causes skin irritation
Causes serious eye irritation
Skin irritation: Irritant
Eye irritation: Irritant

Sensitizing effects

Based on available data, the classification criteria are not met.
Irritant

Specific target organ toxicity (STOT) - single exposure

Based on available data, the classification criteria are not met.

Severe effects after repeated or prolonged exposure

Based on available data, the classification criteria are not met.
STOT - Single exposure: Not classified.
STOT - Repeated exposure: Not classified.
Aspiration hazard: Not classified.

Carcinogenic/mutagenic/toxic effects for reproduction

Based on available data, the classification criteria are not met.
Carcinogenicity: Not classified.
Mutagenicity: Not classified.
Teratogenicity: Not classified.

Carcinogenicity (NTP): Not listed
Carcinogenicity (IARC): Not listed
Carcinogenicity (OSHA): Not listed

Aspiration hazard

Based on available data, the classification criteria are not met.

Practical experience

Other observations

Ingestion causes irritation of upper respiratory system and gastrointestinal disturbance.
Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

12. Ecological information

Ecotoxicity

Citric acid :
LC50/Leuciscus idus/96 h: 440 - 706 mg/l

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

EC50/Daphnia magna: 85 mg/l
Adipic acid:
LC50/Pimephales promelas/96 h: 97 mg/l

Persistence and degradability

Product is biodegradable.

Bioaccumulative potential

No data available.

Mobility in soil

The product is soluble in water.

Other adverse effects

No data available.

13. Disposal considerations

Waste treatment methods

Advice on disposal

Remove in accordance with local official regulations.

Contaminated packaging

Empty containers should be taken for local recycling, recovery or waste disposal.
Contaminated packaging should be emptied as far as possible and after appropriate cleansing may be taken for reuse.
Packaging that cannot be cleaned should be disposed of like the product.

14. Transport information

US DOT 49 CFR 172.101

Proper shipping name: Not regulated.

Other applicable information

Non hazardous material as defined by the transport regulations.

15. Regulatory information

U.S. Regulations

National Inventory TSCA

All of the components are listed on the TSCA inventory.

National regulatory information

SARA Section 304 CERCLA:
Adipic acid (124-04-9): Reportable quantity = 5,000 (2270) lbs. (kg)
SARA Section 311/312 Hazards:
Citric acid (77-92-9): Immediate (acute) health hazard
Malic acid (617-48-1): Immediate (acute) health hazard
Adipic acid (124-04-9): Immediate (acute) health hazard

SARA

To the best of our knowledge this product contains no toxic chemicals subject to the supplier notification requirements of Section 313 of the Superfund Amendments and Reauthorization Act (SARA/EPCRA) and the requirements of 40 CFR Part 372.

State Regulations

Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65, State of California)

This product contains no chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Rational AG

Safety Data Sheet

according to 29 CFR 1910.1200(g)

Oven Delimer Tablets for RATIONAL SelfCookingCenter®, Art. Nr. 56.00.560, 56.00.562

16. Other information

Hazardous Materials Information Label (HMIS)

Health:	2
Flammability:	0
Physical Hazard:	0

NFPA Hazard Ratings

Health:	2
Flammability:	0
Reactivity:	0
Unique Hazard:	



Changes

Revision date:	03.02.2016
Revision No:	6,1

-

Other data

The information in this document is based on the present state of knowledge and is applicable to the product with regard to appropriate safety precautions.
The information describes exclusively the safety requirements for the product (s) and is based on the present level of our knowledge.
The delivery specifications are contained in the corresponding product sheet.
This data does not constitute a guarantee for the characteristics of the product(s) as defined by the legal warranty regulations.
(n.a. = not applicable; n.d. = not determined)

(The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.)

3M™ Water Filtration Products

SPEC# _____

QUANTITY _____

application: **SCALE CONTROL**



model:

SF165

The 3M Purification Inc. Water Filtration Products SF165 Scale-GARD™ HT System helps provide consistent Recipe Quality Water™ with reduced sediment and chlorine taste and odor. Operating cost savings from the controlled and metered addition of scale-inhibitors reduces the ability of calcium and magnesium to precipitate as hard scale in both high and low temperature applications, including ice machines, coffee, tea, espresso brewers and steamers*.

- ScaleGARD HT, SF165 combines chlorine taste and odor reduction withs ediment reductions and helps protect against the effects of scale formation at flow rates to 3.34 gpm (12.6 lpm) for 35,000 gallons (132,000 liters).

PRODUCT BENEFITS

- Advanced Integrated Membrane Pre-Activated Carbon Technology ("IMPACT") filtration media combines a membrane in series with premium activated carbon to provide superior throughput and cartridge life.
- Reduced sediment and chlorine taste and odor for equipment protection and great tasting hot and cold beverages and ice.
- A forced-feed orifice carefully controls and meters the addition of a proprietary scale inhibitor to reduce scale build-up on heating coils.
- Superior scale reduction performance in equipment from ice machines to equipment heating water to temperatures over 200°F (93°C).
- Sanitary Quick Change (SQC) HF65 encapsulated cartridge design allows for fast and easy change-outs with a 1/4 turn while minimizing the possibility of leakage and contamination.
- 3/4" FNPT inlet and outlet ports allow direct or easily adaptable connections to existing plumbing lines.
- FDA CFR-21 and/or NSF compliant materials.
- System includes a pressure gauge, inlet shut-off valve and outlet check valve for simple installation and operation.

PRODUCT SPECIFICATIONS

Model Number	Part Number	Reduction Claims	Micron Rating	Capacity	Service Flow Rate	Application	Replacement Cartridge	Sizing
SF165	56186-01	Sediment, Chlorine Taste and Odor, Scale	3	35,000 gallons (132,000 liters)	3.34 gpm (12.6 lpm)	Normal to Hard Water	HF65 (56134-07) HF8-S (55821-06) Cartpak (56138-11)	Ice: Cubers to 1,200 lbs. (544 kg) Flakers to 2,400 lbs. (1,089 kg) Coffee Brewers and Steamers to demand flow rates of 3.34 gpm (12.6 lpm)

* Periodic acid de-liming of heating coils is recommended for steamer applications.

SF165

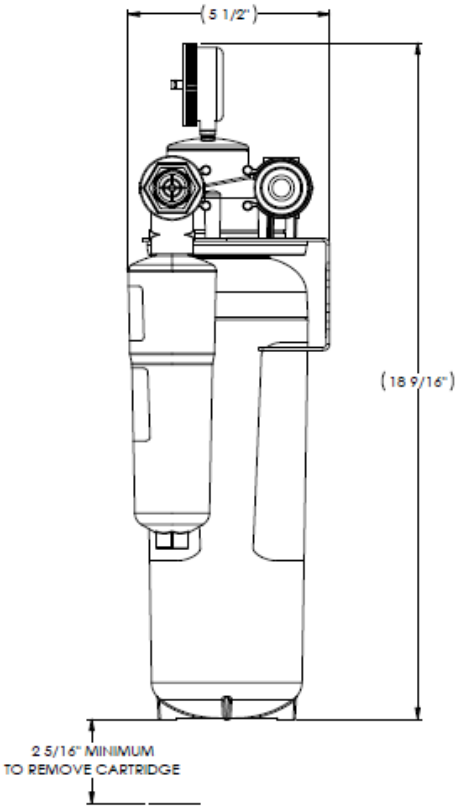
SPEC# _____

QUANTITY _____

MODEL NUMBER _____

PART NUMBER _____

3M Purification Inc. Water Treatment Products



⚠**WARNING: To reduce the risk associated with the ingestion of contaminants:**

- **Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.**

3M Purification Inc. recommends regularly scheduled maintenance and replacement of the filter cartridge(s) in order for the product to perform as advertised/sold. 3M Purification shall not be liable for system failures due to improper maintenance.

PHYSICAL SPECIFICATIONS

- System includes a manifold with built-in pressure gauge, inlet water shut-off valve, outlet check valve, mounting bracket, filter cartridge and scale-feeding system.
- Inlet and outlet plumbing connections are 3/4" FNPT.
- Filter cartridges are o-ring seal type.
- System maximum operating pressure of 125 psi (862 kPa) and operating temperatures of 100°F (37.8°C).
- Recommended service flow rate is up to 3.34 gpm (12.6 lpm)
- Filter cartridge incorporates carbon block media protected by a pleated pre-filter membrane.
- All wetted parts and media are FDA CFR-21 compliant.
- Cartridges are sanitary in design, requiring no contact with the filter media during cartridge change-out.
- Filter cartridges requires no pre-activation.
- Shipping Weight: 6 lbs. (2.7 kg).
- Operating Weight: 12 lbs. (5.4 kg).

IMPORTANT: INSTALLATION TIPS

These installation tips are for informational purposes only and are not intended to be used as actual installation instructions. CAUTION: To reduce the risk associated with property damage due to water leakage:

- **Read and follow** Use Instructions before installation and use of this system.
- Installation and use **MUST** comply with all state and local plumbing codes.
- **Protect from freezing,** remove filter cartridge when temperatures are expected to drop below 40°F (4.4°C).
- **Do not install on hot water supply lines.** The maximum operating water temperature of this filter system is 100°F (37.8°C).
- **Do not install** if water pressure exceeds 125 psi (862 kPa). If your water pressure exceeds 80 psi (552 kPa), you must install a pressure limiting valve. Contact a plumbing professional if you are uncertain how to check your water pressure.
- **Do not install** where water hammer conditions may occur. If water hammer conditions exist you must install a water hammer arrester. Contact a plumbing professional if you are uncertain how to check for this condition.
- The disposable filter cartridge **MUST** be replaced every 12 months, at the rated capacity or if a noticeable reduction in flow rate occurs.

LIMITED WARRANTY

3M Purification Inc. warrants this Product will be free from defects in material and manufacture for five (5) years from the date of purchase: The filter cartridge or filter membrane is warranted to be free from defects in material and manufacture for one (1) year. This warranty does not cover failures resulting from abuse, misuse, alteration or damage not caused by 3M Purification Inc. or failure to follow installation and use instructions. No warranty is given as to the service life of any filter cartridge or membrane as it will vary with local water conditions and water consumption. **3M PURIFICATION INC. MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOMER OR USAGE OF TRADE.** If the Product fails to satisfy this Limited Warranty during the warranty period, 3M Purification Inc. will replace the Product or refund your Product purchase price. This warranty does not cover labor. **The remedy stated in this paragraph is Customer's sole remedy and 3M Purification Inc.'s exclusive obligation. For additional information, see the entire Limited Warranty located in the product Installation and Operating Instruction Manual.**

Limitation of Liability: 3M Purification Inc. will not be liable for any loss or damage arising from this 3M Purification Inc. product, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

3M

3M Purification Inc.
400 Research Parkway
Meriden, CT 06450 U.S.A.
Toll Free: 1.800.243-6894
Worldwide: 203.237.5541
Fax: 203.630.4530
www.3Mpurification.com

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70-0201-9437-2
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John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

071917

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"ST6R5-SSK" STAINLESS STEEL TOP WORK TABLES

16GA TOP W/ 5" RISER AND STAINLESS STEEL LEGS AND ADJUSTABLE UNDERSHELF

FEATURES:

- 16 GAUGE STAINLESS STEEL TOP W/ 5" RISER & TURNDOWN
- TYPE 300 STAINLESS STEEL WITH # 4 POLISH, SATIN FINISH
- TOP IS SOUND DEADENED
- REINFORCED WITH 1"X2" CHANNEL RUNNING ENTIRE LENGTH OF TABLE
- 1-1/2" STALLION EDGE ON FRONT SIDE EDGES 90 DEGREE BEND DOWN FOR TABLE LINE-UP
- STAINLESS STEEL BASE WITH ADJUSTABLE UNDERSHELF
- ADJUSTABLE BULLET FEET
- SHIPPED KNOCKED-DOWN, EASY-TO-ASSEMBLE
- NSF AND CSA CERTIFIED



ST6R5-3048SSK

CONSTRUCTION:

- TOP: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.

MATERIAL:

- TOP: 16 GAUGE STAINLESS STEEL TYPE 300 STAINLESS STEEL WITH # 4 POLISH, SATIN FINISH
- SHELF: 18 GAUGE STAINLESS STEEL, (36" WIDE TABLES, 16 GAUGE LOWER SHELF)
- LEGS: 1-5/8" ROUND O.D. 16 GAUGE TUBULAR STAINLESS STEEL
- GUSSETS: STAINLESS STEEL
- FEET: 1" ADJUSTABLE STAINLESS BULLET FEET



ADJUSTABLE SHELF

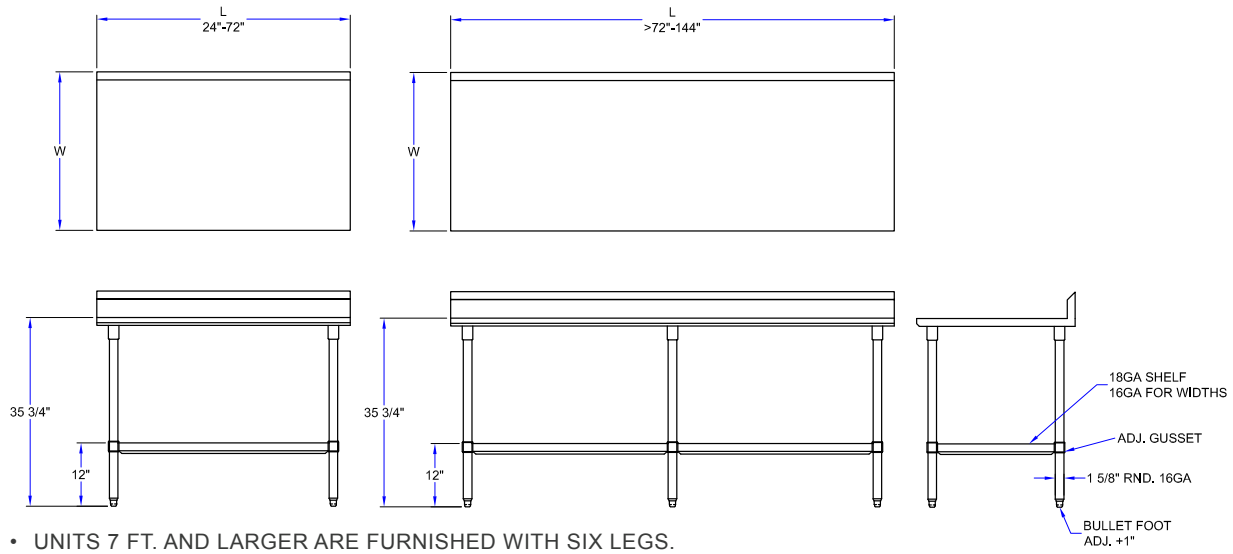
16 GAUGE TOP W/ ADJUSTABLE SHELF

24" WIDE	QTY	30" WIDE	QTY	36" WIDE	QTY
ST6R5-2424SSK		ST6R5-3024SSK		ST6R5-3624SSK	
ST6R5-2430SSK		ST6R5-3030SSK		ST6R5-3630SSK	
ST6R5-2436SSK		ST6R5-3036SSK		ST6R5-3636SSK	
ST6R5-2448SSK		ST6R5-3048SSK		ST6R5-3648SSK	
ST6R5-2460SSK		ST6R5-3060SSK		ST6R5-3660SSK	
ST6R5-2472SSK		ST6R5-3072SSK		ST6R5-3672SSK	
ST6R5-2484SSK		ST6R5-3084SSK		ST6R5-3684SSK	
ST6R5-2496SSK		ST6R5-3096SSK		ST6R5-3696SSK	
ST6R5-24108SSK		ST6R5-30108SSK		ST6R5-36108SSK	
ST6R5-24120SSK		ST6R5-30120SSK		ST6R5-36120SSK	
ST6R5-24132SSK		ST6R5-30132SSK		ST6R5-36132SSK	
ST6R5-24144SSK		ST6R5-30144SSK		ST6R5-36144SSK	

OPTIONAL ACCESSORIES

DESCRIPTION	MODEL #	QTY
DRAWER		
DRAWER LOCK		
CASTERS		
OVERSHELVES		
SINKS		
POT RACK		

DETAILED SPECIFICATIONS



- UNITS 7 FT. AND LARGER ARE FURNISHED WITH SIX LEGS.
- FINISHED SIZE OF UNDERSHELF.
  SHELF LENGTH = LENGTH MINUS 4.875”
  SHELF WIDTH = WIDTH MINUS 4.25

16 GAUGE TOP W/ ADJUSTABLE UNDERSHELF

LENGTH	24" WIDE	WT. (LBS)	30” WIDE	WT. (LBS)	36” WIDE	WT. (LBS)
24"	ST6R5-2424SSK	44	ST6R5-3024SSK	49	ST6R5-3624SSK	58
30"	ST6R5-2430SSK	49	ST6R5-3030SSK	54	ST6R5-3630SSK	68
36"	ST6R5-2436SSK	55	ST6R5-3036SSK	62	ST6R5-3636SSK	75
48"	ST6R5-2448SSK	67	ST6R5-3048SSK	77	ST6R5-3648SSK	93
60"	ST6R5-2460SSK	80	ST6R5-3060SSK	91	ST6R5-3660SSK	111
72"	ST6R5-2472SSK	92	ST6R5-3072SSK	105	ST6R5-3672SSK	129
84"	ST6R5-2484SSK	111	ST6R5-3084SSK	127	ST6R5-3684SSK	159
96"	ST6R5-2496SSK	123	ST6R5-3096SSK	142	ST6R5-3696SSK	177
108"	ST6R5-24108SSK	136	ST6R5-30108SSK	155	ST6R5-36108SSK	193
120"	ST6R5-24120SSK	147	ST6R5-30120SSK	170	ST6R5-36120SSK	211
132"	ST6R5-24132SSK	159	ST6R5-30132SSK	184	ST6R5-36132SSK	228
144"	ST6R5-24144SSK	171	ST6R5-30144SSK	199	ST6R5-36144SSK	246

MODEL # STRUCTURE



SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"
John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

Item # _____ C.S.I. Section 11420

GRIDDLES & BROILERS

VULCAN

VCCB SERIES
COUNTER MODEL GAS CHARBROILER



Model VCCB47

- ☐ **VCCB25** 25¼" wide
- ☐ **VCCB36** 36" wide
- ☐ **VCCB47** 46¾" wide
- ☐ **VCCB60** 60" wide
- ☐ **VCCB72** 72" wide

STANDARD FEATURES

- Stainless steel sides, control panel, top trim, backsplash and grease trough.
- Full width front grease drawers.
- Heavy duty cast iron char-radiants and burners.
- 5¼" wide sloped cast iron grates are reversible for "level" broiling or self-cleaning. Cast in pitched grease trough in each grate blade provides fat run-off and controls flare-ups.
- One 14,500 BTU/hr. burner for each broiler grate.
- Standing pilot ignition system.
- One infinite heat control valve for each burner.
- Underburner deflector system reflects heat upwards creating a "Cool Zone" in the grease drawer and drip areas.
- 4" adjustable legs.
- ¾" rear gas connection and gas pressure regulator.
- One year limited parts and labor warranty.

SPECIFICATIONS

Low profile, high volume gas charbroiler, Vulcan Model No. _____. Stainless steel front, sides, top trim and grease trough. Full width front grease collection drawers. Heavy duty cast iron char-radiants and burners. 5¼" wide cast iron grates. One 14,500 BTU/hr. burner for each broiling grate. Underburner deflector system reflects heat upwards. Standing pilot ignition system. One infinite heat control valve for each burner. 4" adjustable legs. ¾" rear gas connection and gas pressure regulator.

Exterior Dimensions:
_____" wide x 27¼" deep x 13" working height.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 5,999 FT.

ACCESSORIES

- ☐ 10" deep plate rail.
- ☐ 6" back and side splash kit.
- ☐ Diamond and waffle pattern cast iron grates.
- ☐ Stainless steel diamond grate.
- ☐ Welded steel round rod grate.
- ☐ Stainless steel stand with undershelf and casters.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

GRIDDLES & BROILERS

VCCB SERIES
COUNTER MODEL GAS CHARBROILER

INSTALLATION REQUIREMENTS:

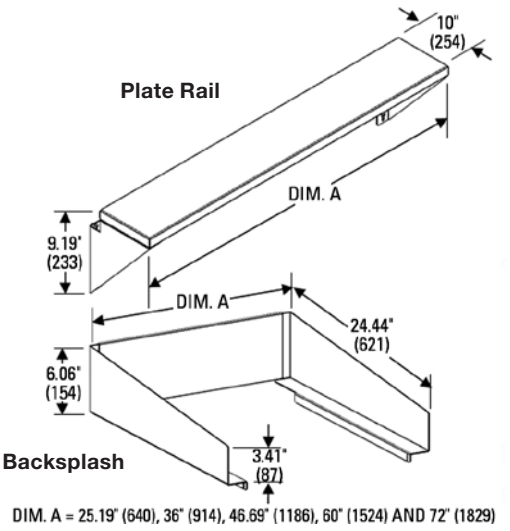
1. A gas pressure regulator supplied with the unit must be installed:
   Natural Gas 5.0" (127 mm) W.C.
   Propane Gas 10.0" (254 mm) W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. When writing refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

NOTE: In The Commonwealth of Massachusetts
All gas appliances vented through a ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.

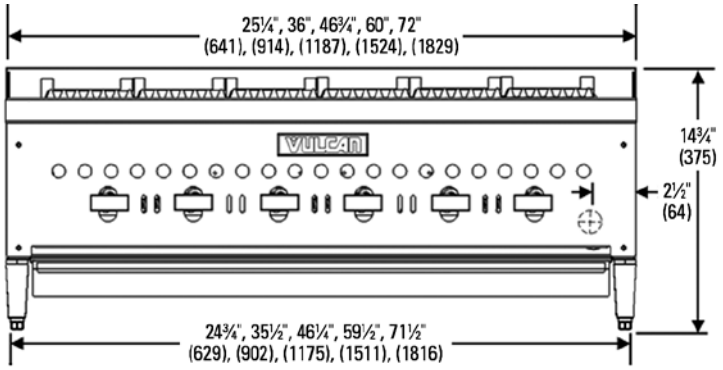
4. CLEARANCES – This model series is for installation in noncombustible locations with the following clearances:

	Back	Right Side	Left Side
Above grid level	3"	0"	0"
Below grid level	3"	0"	0"

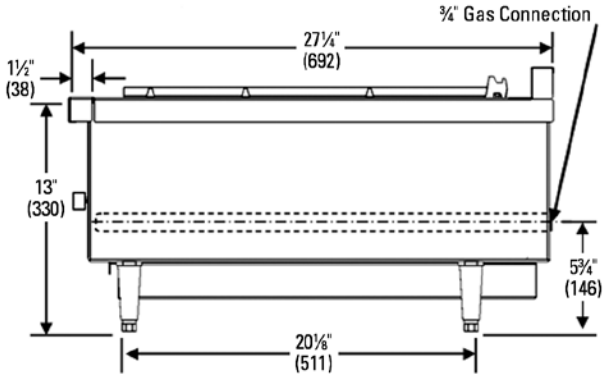
5. This appliance is manufactured for commercial installation only and is not intended for home use.



DIM. A = 25.19" (640), 36" (914), 46.69" (1186), 60" (1524) AND 72" (1829)



FRONT VIEW



SIDE VIEW

MODEL	ACCESSORY CODE		
	BACKSPLASH	PLATE RAIL	STAND
VCCB25	SPLASH6-CB25	PLTRAIL-VCCB25	STAND/C-24
VCCB36	SPLASH6-CB36	PLTRAIL-VCCB36	STAND/C-36
VCCB47	SPLASH6-CB47	PLTRAIL-VCCB47	STAND/C-48
VCCB60	SPLASH6-CB60	PLTRAIL-VCCB60	STAND/C-60
VCCB72	SPLASH6-CB72	PLTRAIL-VCCB72	STAND/C-72

MODEL	WIDTH	DEPTH	OVERALL HEIGHT	WORKING HEIGHT*	BROILING AREA	# BURNERS	TOTAL BTU/HR	APPROX SHIP WT (LB/KG)
VCCB25	25¼"	27¼"	14¾"	13"	21½" X 20½"	4	58,000	265/120
VCCB36	36"				32" X 20½"	6	87,000	355/161
VCCB47	46¾"				43" X 20½"	8	116,000	460/209
VCCB60	60"				56⅜" X 20½"	11	159,500	600/272
VCCB72	72"				66⅜" X 20½"	13	188,500	720/327

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

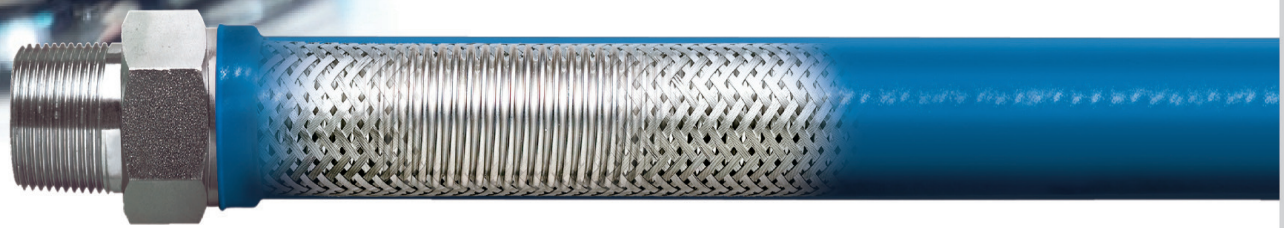
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Dormont
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Boelter.Premier Foodservice
Lifetime - Holladay, UT

Dormont®

Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY

Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
Always on the mark
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

S-BUYGUIDE-Front.indd 1
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Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	 THE BLUE HOSE™	 SnapFast® QUICK-DISCONNECT	 Swivel MAX® 1st SWIVEL	 Swivel MAX® 2nd SWIVEL	 Safety Quik® VALVE	 RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.



Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

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CR72A

72” Low-Profile Refrigerated Chef Base

CR72A
05/12/25
Item # 13490

W x D x H
72.5” x 32.25” x 26”*
*to work surface with 4” casters

Item #: _____
Project: _____
Qty: _____
AIA#: _____



Features

- **Heavy duty 16 gauge stainless steel top with marine edge (front/rear), drip edge (sides)**
- **Ceramic heat shield integral to top protects food from high heat**
- **1500 pound capacity provides sturdy base for cooking equipment**

- Environmentally friendly R290 hydrocarbon refrigerant
- Stainless steel exterior front, sides and top
- Stainless steel interior sides and back with stainless steel interior floor
- Solid state digital controller with temperature alarms and LED display (Fahrenheit or Celsius)
- Cabinet and drawers are insulated with 2” CFC free foamed in place polyurethane
- Stainless steel exterior drawer with stainless steel interior
- Drawer module frames, acetal rollers and drawer stops are formed of heavy duty stainless steel all welded construction and securely fastened in the cabinet
- Drawers will accommodate (2) 12” x 20” x 6” deep pans (pans by others)
- Drawers are equipped with finger cut-outs for easy removal of pans
- Extruded aluminum flush mount drawer handles
- Magnetic drawer gasket is easily removable for cleaning
- Removable stainless steel end panel for access to refrigeration system
- E-coated evaporator coil
- Energy efficient automatic hot gas condensate evaporator
- Standard with (6) 4" casters all with brakes
- 10 ft. cord and plug

If GFCI is required, a GFCI breaker MUST be used in lieu of GFCI receptacle

Dimensions / Capacity	Two-Section CR72A
Interior Storage Capacity (CF)	17.26 ft³
Interior Storage Capacity (CF) (AHAM)	15.44 ft³
Overall Width x Depth (including 1” bumper)	72.5” x 33.25”
Overall Height (including 4” casters)	27”
Height To Work Surface (including 4” casters)	26”
Depth with Drawer Fully Open (including 1” bumper)	55.75”
Drawer Opening Width	27.75”
Pan Capacity (12” x 20”) / per drawer	8 total / 2 per drawer
Maximum Pan Depth	6”
Maximum Load Capacity	1500 lbs.
Crated Shipping Weight	500 lbs.
Crated Length x Width x Height	74” x 34.5” x 30.5”

Electrical / Refrigeration	Two-Section CR72A
Voltage	115/60/1
HACR Breaker	15.0 Amps
Electrical Connection (NEMA)	5-15P
Voltage Range	104-126
Ambient Temp. Range	45° to 100°F
Control Setpoint Range	32° to 52°F
Amperage	3.0
Energy Consumption (kWh/day) @NSF	2.78
Heat Rejection (BTU/Hr.) @NSF	395
Approx. Nominal Compres. BTU/HR (HP)	1354(1/5HP)
Refrigerant / Charge Amount (oz)	R290(4.1 oz)

Options

☐ HS-4007 - Drawer divider bars

Seven year warranty on labor, parts, and compressor. Valid in United States, Canada, Puerto Rico and U.S. Territories.

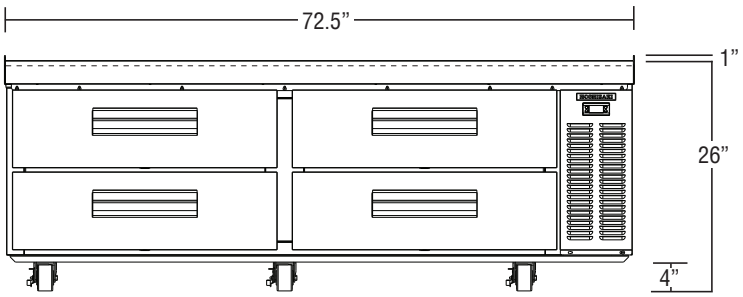
For more information, please visit hoshizakiamerica.com/support/warranty/

Hoshizaki reserves the right to change specifications without notice.

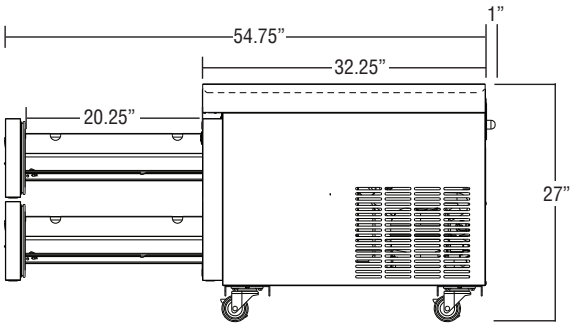
CR72A

72” Low-Profile Refrigerated Chef Base

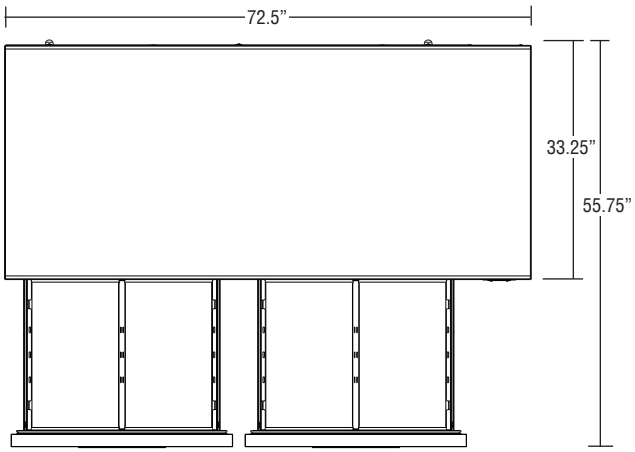
FRONT VIEW



SIDE VIEW

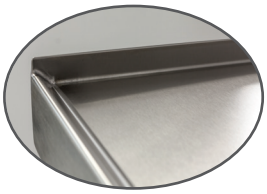


PLAN VIEW



CLEARANCES

- Top: A minimum of 4” (11cm) clearance is required between the bottom of the cooking equipment heating element and the appliance top. Temperature at the appliance top must not exceed 180°F (82°C).
- Sides: 1” (25mm) clearance
- Rear: The factory installed rear bumpers must be in place to ensure proper rear clearance.



16 gauge stainless steel top with built in heat shield and 1” drip edge

Cabinet Construction

The exterior cabinet front, sides, and top are constructed of high quality stainless steel. The exterior back and bottom are constructed of coated steel. The cabinet interior walls and ceiling are stainless steel. The floor is constructed of heavy gauge stainless steel with coved corner construction. Heavy duty ABS thermal breaks are used to reduce heat transfer in the frames. Cabinet walls and drawers are insulated with 2” of environmentally friendly CFC free, foamed in place polyurethane. 4” heavy duty platform casters (all with brakes) are standard and installed at the factory.

Drawer Construction

Drawer fronts are constructed of high grade stainless steel with stainless steel interior and are insulated with CFC free, foamed in place polyurethane. Each drawer accommodates (2) 12” X 20” X 6” deep pans (pans by others). (Drawers will also accept 1/2, 1/3rd and 1/6th size pans with optional adapter bars). Drawer module frames are formed of heavy duty stainless steel all welded construction and securely fastened in the cabinet. The drawer slides are constructed of heavy duty stainless steel with durable acetal rollers with stainless steel ball bearings to prevent metal to metal contact. The drawer slides have been life tested (fully loaded) three hundred thousand cycles without showing significant wear. The flush mount handles are constructed of extruded aluminum. Snap-in magnetic drawer gaskets are durable and easily removed for cleaning.

Refrigeration System

Solid state digital controller with temperature alarms maintains optimum cabinet temperature. A LED display shows the cabinet temperature and is adjustable to Fahrenheit or Celsius. The CR72A has a front breathing refrigeration system. The high efficiency refrigeration system is standard with an E-coated evaporator for extended life. Condensate removal is accomplished with an energy efficient hot gas condensate evaporator system. A capillary tube controls the flow of environmentally friendly R290 refrigerant through the evaporator. Refrigeration system utilizes an automatic, time-initiated, heated defrost to eliminate any ice on the evaporator coil. 115 volt units are equipped with a ten foot cord and plug (20.0 amps or less).



ND Series

Exhaust-Only Hood

Captive-Aire's flagship ND hood is a wall canopy exhaust-only unit that operates at low CFM. It is ETL Listed for use over 450°F, 600°F, and 700°F cooking surface temperatures.

Offering A Fully Integrated Package, Pre-Engineered For Optimum Performance

ADVANTAGES

- **Exhaust Flow Rates:** Superior exhaust flow rates. A 4' Hood can operate at 150 CFM/ft or 600 total CFM.
- **ETL Listed:** ETL Listed for use over 450°F, 600°F and 700°F cooking surface temperatures, provides flexibility in designing kitchen ventilation systems. ETL Listed to Canadian safety standards, NSF Listed and built in accordance with NFPA 96.
- **Front Design:** Double Wall front design prevents condensation and directs grease-laden vapors toward the exhaust filter bank.
- **Stainless Steel Construction:** Polished stainless steel on the interior and exterior of the front enhance aesthetics.
- **Optional Make-Up Air:** Up to 80% make-up air can be supplied through an optional front plenum (ND Series with PSP Accessory), or up to 90% with an optional rear plenum (ND-BR Series), or front and rear plenums (ND-BR Series with PSP Accessory).
- **Sturdy Construction:** Sturdy stainless steel construction with double wall, insulated front panel.
- **Pre-wiring at Factory:** Factory pre-wired lighting to illuminate the cooking surface.
- **Industrial Grease Baffle Filters:** All hoods come standard with aluminum baffle filters. Stainless steel filters are optional. High velocity cartridge filters are available on the CND series.
- **Clearance to Combustibles:** Optional integral clearance to combustibles reduction system to meet NFPA 96 requirements.
- **Face Mounted Controls:** Optional UL Listed light and fan control switches flush mounted and pre-wired through electrical chaseway.
- **Capture & Containment:** Exceptional capture and containment of cooking vapors. This is accomplished with the signature ND "triangle" on the front of the hood's capture area and the "C-shaped" design of the hood's capture area.
- **ETL Listed Fire Damper:** Optional ETL Listed exhaust fire damper on the ND-100 model.

PERFORMANCE

Max. Avg. Cooking Surface Temp. (°F)	Configuration	Min. Exhaust CFM/ft.
450°F - Ovens, Steamers, Kettles, Open-Burner Ranges, Griddles, Fryers	Single Wall Hood	150
	2 Wall Hoods Back-to-Back in an Island Configuration	300
600°F - Gas Charbroilers, Electric Charbroilers, Woks	Single Wall Hood	200
	2 Wall Hoods Back-to-Back in an Island Configuration	400
700°F - Mesquite Grills, Charcoal Charbroilers, Gas Conveyor Charbroilers	Single Wall Hood	250
	2 Wall Hoods Back-to-Back in an Island Configuration	500

Recommended Duct Sizing:

- Exhaust - Based on 1500 FPM

FEATURES

- Available in single wall type or two piece back-to-back island configuration.
- Fabricated of Type 430 stainless steel, #3 or #4 polish, on all exposed surfaces. Optional type 304 stainless steel available.
- Double-wall, insulated front increases rigidity and reduces condensation.
- Fitted with UL Classified, aluminum filters, removable for cleaning. Optional stainless steel and ETL Listed high velocity cartridge filters available. (Model CND)
- Grease drain system (1/8" per foot minimum slope) with removable pint cup for easy cleaning.
- Pre-punched hanging angles on each end of hood. Additional set provided for hoods longer than 12'.
- Optional integral clearance to combustibles reduction system to meet NFPA 96 requirements.
- Fitted with UL Listed, pre-wired, incandescent light fixtures and plastic-coated glass globes to hold up to a standard 100 watt bulb. Recessed incandescent and recessed fluorescent lights optional.
- A built-in wiring chase provided for optimal positioning of electrical controls and outlets on the front face of the hood without penetrating capture area or requiring external chaseway.
- Optional ETL Listed exhaust fire damper (Model ND-100).
- ETL Listed for 450°F, 600°F and 700°F cooking surfaces (File 3054804-001 without exhaust damper; File 3054804-002 with exhaust damper), NSF Listed and built in accordance with NFPA Standard 96.

OPTIONS

Utility Cabinet: ETL Listed for integral side mount on the Captive-Aire Systems ventilation hood...fabricated of same material as hood...the cabinet houses factory pre-piped UL Listed fire suppression system* and ETL Listed, pre-wired electrical controls...pre-wire package* contains light switches, lighted fan control switches and internal factory wiring and components (starters, relays, etc.) to reduce field wiring requirements. ETL tests confirm temperatures do not exceed 120°F inside the cabinet during fire condition. (120°F is the maximum allowed storage temperature for the UL Listed fire suppression system and the ETL Listed Industrial control panel.) (*Dimensional restrictions may apply)

Rear Make-Up Air Plenum: Provides make-up air for the kitchen, discharged below cooking equipment...welded...stainless steel exposed surfaces...unexposed surfaces made of aluminized metal...shipped separately, requiring field connection...insulated to prevent condensation...perforated diffuser plates for even air distribution. Provides required clearance from limited combustibles per NFPA 96 Standards.

Front Perforated Supply Plenum: Provides low velocity make-up air for the kitchen, discharged in front of the hood...welded...stainless steel...perforated diffuser plates for even air distribution...supply riser includes a volume damper for easy balancing.

Removable, ETL Listed, High Velocity Cartridge Filters: Constructed of stainless steel...uses centrifugal force to remove grease and other particulates...National Institute of Standards and Technology methodology used by an independent agency to evaluate performance...tests indicate 95 percent extraction efficiency.

Enclosure Panels: Constructed of stainless steel...mounting channel factory-welded to hood for field installation of panels over 11" high...under 11", factory-welded and integrally installed into hood front ends...sized to extend from hood top to ceiling, enclosing pipe and hanging parts.

End Panels: Should be used to maximize hood performance and eliminate the effects of cross drafts in kitchen...units constructed of stainless steel and sized according to hood width and cooking equipment. Exposed edges hemmed for safety and rigidity.

Exhaust Fire Damper: ETL Listed...installed in exhaust collar...activated by a ETL Listed, 212°F, 10-lb. minimum rated fusible link.

Roof Top Package: Combination ETL Listed exhaust/supply air unit with factory prewired and mounted motors, trunkline and curb vented on exhaust side. Various models perform up to 14,000 CFM exhaust and up to 3 inches static pressure...weatherproofed...galvanized construction... washable mesh filters...exhaust/supply air fans share common roof penetration...internal wiring drops directly through curb, requiring no pitch pockets...exhaust outlets/air intakes spaced to conform to code regulations...automatic reset/thermal overload protection on all single phase motors and on three phase motors if pre-wire assembly is included in package...standard single-point power connections...UL 705, 762 Listed exhaust fans rated for high grease applications...optional backdraft dampers.

Separate Exhaust and/or Make-Up Air Fans: ETL Listed single exhaust fans and supply-air fans and curbs available...same features, construction methods and performance ratings as roof top package above.

Heated Make-Up Air Unit: ETL Listed direct fired gas heated make-up air unit manufactured... ETL Listed for natural gas and propane... design integrates the blower and burner into a single package... heavy duty, weather resistant, galvanized steel construction... units available in Roof Top Package or as a stand alone heated make-up air module... several sizes available to meet almost any performance rating specification.

Fire Suppression System: UL 300 pre-piped fire suppression system...Custom designed to your cooking equipment line-up.

Construction: 430 and 304 stainless steel construction...On exposed surfaces or 100%.

Clearance to Combustibles: Integral clearance to combustibles system that meets NFPA 96 requirements.

Electrical Controls: ETL listed controls... Face mounted switches.

New York City School Construction Authority Requirements: The CND Series hood with the SCA option package (CND-SCA) is manufactured to meet New York City School Construction Authority requirements. Contact a Captive-Aire sales representative for more information.

FULLY INTEGRATED PACKAGE

Captive-Aire sells this hood as a stand-alone appliance to be integrated into a kitchen ventilation application. Captive-Aire also provides this hood as part of a **FULLY INTEGRATED PACKAGE** designed by Captive-Aire and pre-engineered for **OPTIMUM PERFORMANCE**. The package consists of the hood, an integral ETL Listed utility cabinet, factory pre-wired ETL Listed electrical controls, and a factory pre-piped UL Listed fire suppression system. Other options include a ETL Listed exhaust damper, a ETL Listed exhaust fan, a ETL Listed non-tempered make-up air fan, and/or a ETL Listed direct-fired heated make-up air unit. Fire suppression systems include final hookup and inspection.

CERTIFICATIONS

The ND Model has been certified by ITS. This certification mark indicates that the product has been tested to and has met the minimum requirements of a widely recognized (consensus) U.S. and Canadian products safety standard, that the manufacturing site has been audited, and that the applicant has agreed to a program of periodic factory follow-up inspections to verify continued performance.

Models ND are ETL Listed under file number 3054804-001 and complies with UL710 Standards and ULC710 Standards.

Project _____

Item # _____

Quantity _____

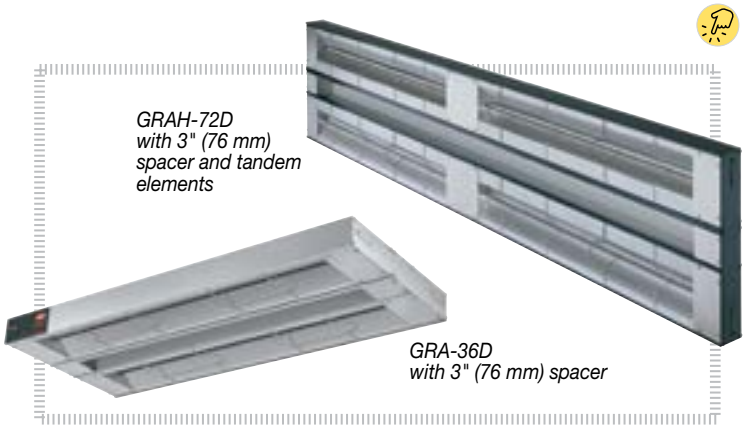
Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models:

GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

Create a deeper holding area with Glo-Ray® Aluminum Dual Infrared Foodwarmers with two heaters mounted side-by-side, keeping hot food at optimum serving temperatures. The pre-focused heat pattern directs heat from a metal sheathed element across the entire holding surface. The continuous aluminum housing and heavy-duty mountings ensure the durability and quality of Hatco products.



Standard features

- Provides even heat distribution – no “cold spots”
- Pre-focused heat maintains safe serving temperatures longer
- Sturdy extruded aluminum housings that do not sag, from 18" to 144" (457 to 3658 mm)
- Reflector does not blacken, maintaining a consistent heat pattern
- Reinforced wire guards provide operator safety without affecting heat distribution
- 3" or 6" (76 or 152 mm) spacer available as a center section between two 6" (152 mm) heater sections for a deeper holding area
- Heavy-duty insulation minimizes heat loss
- Optional sneeze guard made of shatterproof, easy-to-clean acrylic provide safe food serving environment
- Additional reflector styles and lower wattage elements also available, please consult factory for more information
- Metal sheathed heating element part guaranteed against burnout and breakage for two years

Options (available at time of purchase only)

Housing – clear Anodized finish Standard
☐ 15" (4572 mm) ☐ 18" (457 mm)
Designer Color or Gloss Finish⊗▪
☐ Warm Red ☐ Black ☐ Gray Granite ☐ White Granite
☐ Navy Blue ☐ Hunter Green ☐ Antique Copper
☐ Radiant Red ☐ Glossy Gray ☐ Bold Black ☐ Gleaming Gold
☐ Brilliant Blue

☐ Indicator Light (Remote only)

Leads – Extended Beyond Standard 3' (914 mm) Conduit
Please specify lead length
☐ 1'-5' (305-1525 mm) ☐ 6'-10' (1829-3048 mm)
☐ 11'-15' (3352-4572 mm) ☐ 16'-20' (4877-6096 mm)

Sneeze Guard
☐ 9.375" (238 mm) – One Side ☐ 9.375" (238 mm) – Two Sides
☐ 14" (356 mm) – One Side ☐ 14" (356 mm) – Two Sides

☐ Remote Infinite Switches in lieu of Toggle (max. 12.2 amps)

☐ Remote Toggle Switches (max. 15 amps)

☐ Remote Box (RMB) – clear Anodized finish Standard
Designer Color or Gloss Finish⊗▪
☐ Warm Red ☐ Black ☐ Gray Granite ☐ White Granite
☐ Navy Blue ☐ Hunter Green ☐ Antique Copper
☐ Radiant Red ☐ Glossy Gray ☐ Bold Black ☐ Gleaming Gold
☐ Brilliant Blue

☐ Factory attaches Control Box to Strip Heater (Export only)

☐ Adjustable Tubular Stands 10"-14" (254-356 mm)
(not available in *Designer* Colors)

Non-Adjustable Tubular Stands – matches housing color – Choose clearance below⊗▪
☐ 10" (254 mm) ☐ 12" (305 mm) ☐ 14" (356 mm) ☐ 16" (406 mm)

Accessories

Adjustable Angle Brackets (with clearance above unit)
☐ 1"-2" (25-51 mm) ☐ 7" (178 mm) - GRA-xxD models only

☐ Chain Suspension

⊗ Non-standard colors are non-returnable

NOTE: Install Remote Box outside Heat Zone or damage will occur.

▪ **IFS anti-microbial coatings use naturally-occurring, environmentally sustainable, silver ions to help inhibit the growth of microbes on the powder coated surface. See www.hatcocorp.com/antimicrobial-paint for more information.**

For operation, location and safety information, please refer to the Installation and Operating Manual.

MADE IN THE USA

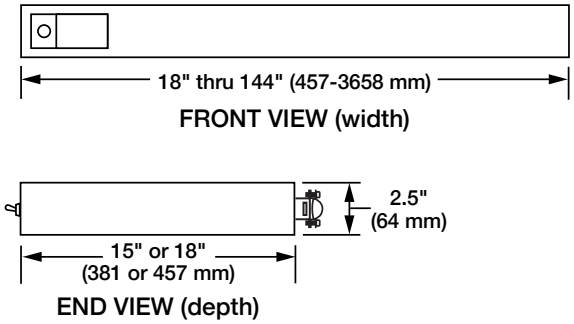
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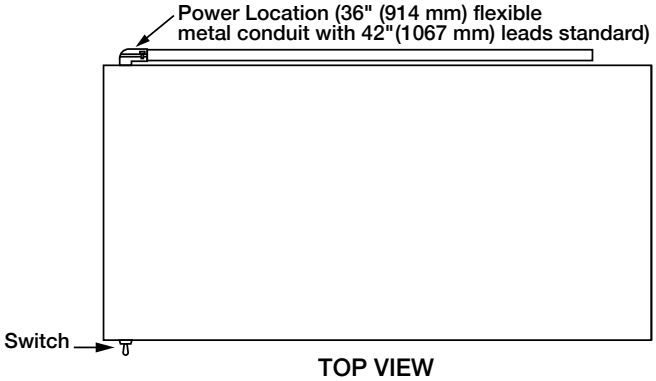
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Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

GRA-D and GRAH-D





Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Width
GRA-18D	120	500	4.2	14 lbs. (7 kg.)	GRAH-18D	120	700	5.8	14 lbs. (7 kg.)	18" (457 mm)
	208		2.4			208		3.4		
	240		2.1			240		2.9		
	–	–	–			100	700	7.0		
	200	462	2.5			200	647	3.5		
	220	500	1.1			220	700	3.2		
	220-230 (CE)‡	500-546	2.3-2.4			220-230 (CE)‡	700-765	3.2-3.3		
	230-240 (CE)‡	459-500	2.0-2.1			230-240 (CE)‡	643-700	2.8-2.9		
	240	500	1.0			240	700	2.9		
GRA-24D	120	700	5.8	16 lbs. (8 kg.)	GRAH-24D	120	1000	8.3	16 lbs. (8 kg.)	24" (610 mm)
	208		3.4			208		4.8		
	240		2.9			240		4.2		
	–	–	–			100	1000	10.0		
	200	647	1.8			200	925	5.0		
	220	700	1.6			220	1000	4.5		
	220-230 (CE)‡	700-765	3.2-3.3			220-230 (CE)‡	1000-1093	4.5-4.8		
	230-240 (CE)‡	643-700	2.8-2.9			230-240 (CE)‡	918-1000	4.0-4.2		
	240	700	1.5			240	1000	4.2		
GRA-30D	120	900	7.5	18 lbs. (9 kg.)	GRAH-30D′	120	1320	11.0	18 lbs. (9 kg.)	30" (762 mm)
	208		4.3			208		6.3		
	240		3.8			240		5.5		
	–	–	–			100	1320	13.2		
	200	832	2.3			200	1220	6.6		
	220	900	2.1			220	1320	6.0		
	220-230 (CE)‡	900-984	4.1-4.3			220-230 (CE)‡	1320-1443	6.0-6.3		
	230-240 (CE)‡	827-900	3.6-3.8			230-240 (CE)‡	1212-1320	5.3-5.5		
	240	900	1.9			240	1320	5.5		
GRA-36D	120	1150	9.6	19 lbs. (9 kg.)	GRAH-36D′	120	1600	13.3	19 lbs. (9 kg.)	36" (914 mm)
	208		5.5			208		7.7		
	240		4.8			240		6.7		
	–	–	–			100	1600	16.0		
	200	1063	2.9			200	1479	8.0		
	220	1150	2.6			220	1600	7.3		
	220-230 (CE)‡	1150-1257	5.2-5.5			220-230 (CE)‡	1600-1749	7.3-7.6		
	230-240 (CE)‡	1056-1150	4.6-4.8			230-240 (CE)‡	1469-1600	6.4-6.7		
	240	1150	4.8			240	1600	6.7		
GRA-42D′	120	1350	11.3	23 lbs. (11 kg.)	GRAH-42D′	120	1900	15.8	24 lbs. (11 kg.)	42" (1067 mm)
	208		6.5			208		9.1		
	240		5.6			240		7.9		
	–	–	–			100	1900	19.0		
	200	1248	6.8			200	1757	9.5		
	220	1350	6.1			220	1900	8.6		
	220-230 (CE)‡	1350-1476	6.1-6.4			220-230 (CE)‡	1900-2077	8.6-9.0		
	230-240 (CE)‡	1240-1350	5.4-5.6			230-240 (CE)‡	1745-1900	7.6-7.9		
	240	1350	5.6			240	1900	7.9		

[a] Shipping weight includes packaging, and does not include RMB.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.
′ 100V and 120V models may require additional switches, consult factory for applications.

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Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Width
GRA-48D[b]	120	1600	13.3	27 lbs. (12 kg.)	GRAH-48D[b]	120	2200	18.3	27 lbs. (12 kg.)	48" (1219 mm)
	208		7.7			208		10.6		
	240		6.7			240		9.2		
	–	–	–			100	2200	22.0		
	200	1479	8.0			200	2034	11.0		
	220	1600	7.3			220	2200	10.0		
	220-230 (CE)‡	1600-1749	7.3-7.6			220-230 (CE)‡	2200-2405	10.0-10.5		
	230-240 (CE)‡	1469-1600	6.4-6.7			230-240 (CE)‡	220-2200	8.8-9.2		
	240	1600	6.7			240	2200	9.2		
GRA-54D[b]	120	1850	15.4	30 lbs. (14 kg.)	GRAH-54D[b]	120	2500	20.8	30 lbs. (14 kg.)	54" (1372 mm)
	208		8.9			208		12.0		
	240		7.7			240		10.4		
	–	–	–			100	2500	25.0		
	200	1710	9.3			200	2311	12.5		
	220	1850	8.4			220	2500	11.4		
	220-230 (CE)‡	1850-2022	8.4-8.8			220-230 (CE)‡	2500-2732	11.4-11.9		
	230-240 (CE)‡	1699-1850	7.4-7.7			230-240 (CE)‡	2296-2500	10.0-10.4		
	240	1850	7.7			240	2500	10.4		
GRA-60D[b]	120	2100	17.5	35 lbs. (16 kg.)	GRAH-60D[b]	120	2800	23.3	34 lbs. (16 kg.)	60" (1524 mm)
	208		10.1			208		13.5		
	240		8.8			240		11.7		
	–	–	–			100	2800	28.0		
	200	1942	10.5			200	2589	14.0		
	220	2100	9.5			220	2800	12.7		
	220-230 (CE)‡	2100-2295	9.5-10.0			220-230 (CE)‡	2800-3060	12.7-13.3		
	230-240 (CE)‡	1929-2100	8.4-8.8			230-240 (CE)‡	2572-2800	11.2-11.7		
	240	2100	8.8			240	2800	11.7		
GRA-66D[b]	120	2320	19.3	36 lbs. (17 kg.)	GRAH-66D[c][b]	120	3120	26.0	38 lbs. (18 kg.)	66" (1676 mm)
	208		11.2			208		15.0		
	240		9.7			240		13.0		
	–	–	–			100	3120	31.2		
	200	2145	11.6			200	2885	15.6		
	220	2320	10.5			220	3120	14.2		
	220-230 (CE)‡	2320-2536	10.5-11.0			220-230 (CE)‡	3120-3410	14.2-14.8		
	230-240 (CE)‡	2131-2320	9.3-9.7			230-240 (CE)‡	2865-3120	12.5-13.0		
	240	2320	9.7			240	3120	13.0		
GRA-72D[c][b]	120	2550	21.3	36 lbs. (17 kg.)	GRAH-72D[c][b]	120	3450	28.8	36 lbs. (17 kg.)	72" (1829 mm)
	208		12.3			208		16.6		
	240		10.6			240		14.4		
	–	–	–			100	3450	34.5		
	200	2358	12.8			200	3190	17.3		
	220	2550	11.6			220	3450	15.7		
	220-230 (CE)‡	2550-2787	11.6-12.1			220-230 (CE)‡[⊙]	3450-3771	15.7-16.4		
	230-240 (CE)‡	2342-2550	10.2-10.6			230-240 (CE)‡[⊙]	3168-3450	13.8-14.4		
	240	2550	10.6			240	3450	14.4		
GRA-84D[c][b]	120	3000	25.0	50 lbs. (23 kg.)	GRAH-84D[⚯][b]	120	4100	34.2	50 lbs. (23 kg.)	84" (2134 mm)
	208		14.4			208		19.7		
	240		12.5			240		17.1		
	–	–	–			100	4100	41.0		
	200	2774	15.0			200	3791	20.5		
	220	3000	13.6			220	4100	18.6		
	220-230 (CE)‡	3000-3279	13.6-14.3			220-230 (CE)‡[⊙]	4100-4481	18.6-19.5		
	230-240 (CE)‡	2755-3000	12.0-12.5			230-240 (CE)‡[⊙]	3766-4100	16.4-17.1		
	240	3000	12.5			240	4100	17.1		
GRA-96D[c][b]	120	3450	28.8	52 lbs. (24 kg.)	GRAH-96D[⚯][b]	120	4800	40.0	52 lbs. (24 kg.)	96" (2438 mm)
	208		16.6			208		23.1		
	240		14.4			240		20.0		
	–	–	–			100	4800	48.0		
	200	3190	17.3			200	4438	24.0		
	220	3450	15.7			220	4800	21.8		
	220-230 (CE)‡[⊙]	3450-3771	15.7-16.4			220-230 (CE)‡[⊙]	4800-5246	21.8-22.8		
	230-240 (CE)‡[⊙]	3169-3450	13.8-14.4			230-240 (CE)‡[⊙]	4408-4800	19.2-20.0		
	240	3450	14.4			240	4800	20.0		

[a] Shipping weight includes packaging, and does not include RMB.
[b] 100V and 120V models may require additional switches, consult factory for applications.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.
[c] 100V and 120V models with infinite switch require tandem (end-to-end) elements, consult factory for applications.
[⚯] Contain tandem (end-to-end) elements that may be individually controlled.
[⊙] Available with RMB or remote switch only. Consult factory for additional charges.

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Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
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Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical nformation for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight▲	Model	Volts	Watt	Amps	Approx. Ship Weight▲	Width
GRA-108D ⁄†⊙✖	120	3700	30.8	59 lbs. (27 kg.)	GRAH-108D ⁄†⊙✖	120	5000	41.7	59 lbs. (27 kg.)	108" (2743 mm)
	208		17.8			208		24.0		
	240		15.4			240		20.8		
	220	3700	16.8			220	5000	22.7		
	220-230	3700-4044	16.8-17.6			220-230	5000-5465	22.7-23.8		
	230-240	3398-3700	14.8-15.4			230-240	4592-5000	20.0-20.8		
	240	3700	15.4			240	5000	20.8		
GRA-120D ⁄†⊙✖	120	4200	35.0	66 lbs. (30 kg.)	GRAH-120D ⁄†⊙✖	120	5600	–	66 lbs. (30 kg.)	120" (3048 mm)
	208		20.2			208		26.9		
	240		17.5			240		23.3		
	220	4200	19.1			220	5600	28.0		
	220-230	4200-4591	19.1-20.0			220-230	5600-6121	25.5-26.6		
	230-240	3857-4200	16.8-17.5			230-240	5143-5600	23.4-23.3		
	240	4200	17.5			240	5600	23.3		
GRA-132D ⁄†⊙✖	120	4640	38.7	73 lbs. (34 kg.)	GRAH-132D†⊙✖	–	6240	–	73 lbs. (34 kg.)	132" (3353 mm)
	208		22.3			208		30.0		
	240		19.3			240		26.0		
	220	4640	21.1			220	6240	28.4		
	220-230	4640-5071	21.1-22.0			220-230	6240-6820	28.4-29.7		
	230-240	4261-4640	18.5-19.3			230-240	5731-6240	24.9-26.0		
	240	4640	19.3			240	6240	26.0		
GRA-144D ⁄†⊙✖	120	5100	42.3	80 lbs. (37 kg.)	GRAH-144D†⊙✖	–	6900	–	80 lbs. (37 kg.)	144" (3658 mm)
	208		24.5			208		33.2		
	240		21.3			240		28.8		
	220	5100	23.2			220	6900	341.4		
	220-230	5100-5574	23.2-24.3			220-230	6900-7542	31.4-32.8		
	230-240	4684-5100	20.4-21.3			230-240	6337-6900	27.6-28.8		
	240	5100	21.3			240	6900	28.8		

▲ Shipping weight includes packaging, and does not include RMB.
✖ CE not available.
⁄ 100V and 120V models may require additional switches, consult factory for applications.
† Glo-Ray models 108"-144" (2743-3658 mm) and 120 volt models of GRAH-84 and GRAH-96 contain tandem (end-to-end) elements that may be individually controlled.
⊙ Available with RMB (Remote Box) or remote switch only. Consult factory for additional charges.

TOGGLE SWITCH: Amps: Max. 15 amps. Location: Chef's left side.
INFINITE SWITCH: Max. 12.2 amps Location: remote installation only
CONDUIT: 3' (914 mm) conduit standard on 120V and 208V models only
LEADS: **US/Canada:** 6" (152 mm) leads, server's right side
Euro/UK GRAH-xxD: 6" (152 mm) pigtail leads with no conduit, servers right side

RECOMMENDED MOUNTING HEIGHTS

(Refer to the Installation section of the Manual on the Hatco website)

Units with 3" (76 mm) and 6" (152 mm) Spacers
Standard Watt: 10"-14" (254-356 mm) **High Watt:** 14"-18" (356-457 mm)

MINIMUM CLEARANCES

Combustibles
Cannot be installed in combustible surroundings

Non-Combustibles

Dual Units with Built-In Switches
Unit to surface below: 10" (254 mm)
Must be installed in pass through area, back wall installation not allowed
Below overshelf: 1" (25 mm) clearance

Dual Units with Remote Switches:
Unit to surface below: 8" (203 mm)
Unit to wall: 3" (76 mm)
Below overshelf: 0" (0 mm) clearance, can be flush to an overshelf

REMOTE CONTROL ENCLOSURES

Must order one RMB control box per Strip Heater - If RMB2 is used, multiple warmers can be controlled from one box.

Click here to download the RMB Choose Remote Box Excel Spreadsheet
or follow this file path: www.hatcocorp.com > Resources > Choose Remote Box

Model	Width	Toggle Switches
RMB-3	6" (150 mm)	2 maximum
RMB-7	9.375" (239 mm)	4 maximum
RMB-14	14.375" (366 mm)	6 maximum
RMB-16	16.375" (417 mm)	3 maximum
RMB-20	20.375" (518 mm)	4 maximum
RMB2-1R	11" (279 mm)	1 toggle, 1 infinite, 1 relay, 1 indicator light
RMB2-2R	14" (356 mm)	1 toggle, 1 infinite, 2 relays, 1 indicator light



Model RMB-14E with infinite controls



RMB-3F with toggle switch and indicator light

PRODUCT SPECS

Infrared Foodwarmers

The Aluminum Dual Infrared Foodwarmer shall be a Glo-Ray®, manufactured by the Hatco Corporation, Milwaukee,WI 53234 U.S.A.

The Foodwarmer shall be a Glo-Ray model ... , rated at ... watts, ... volts, single phase, and be ... inches (millimeters) in overall width. The Glo-Ray shall consist of an aluminum housing and include four shelf mounting tabs, and 3' (914 mm) conduit with leads.

The infrared heating element shall be tubular metal sheathed. The foodwarmer shall be factory-assembled ready for electrical installation.

Options and accessories shall include adjustable or non-adjustable tubular stand, angle brackets, suspension chain and fittings, sneeze guard and indicator light. Housing and RMB shall be offered in Optional *Designer* Color and Gloss Finish anti-microbial paint.

Warranty consists of 24/7 parts and service assistance (U.S. and Canada only).

Delfield®

4448NP

Front-Breathing Self-Contained Flat Top Refrigerated Bases

Models

- 4448NP Single Section with Doors
- D4448NP Single Section with Drawers
- ST4448NP Single Section with Doors with Backsplash
- STD4448NP Single Section with Drawers with Backsplash



4448NP

Standard Features

- All 4400 Series units are 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet, or an existing lineup.
- Durable, rugged stainless-steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable – it won't dent, chip or corrode and is backed by a limited lifetime warranty.
- "D" prefix models feature Delfield's new drawer system. Drawers are backed by a lifetime warranty on the track assembly.
- Bent in full length handle on doors and drawers.
- Standard on 5" casters for easy cleaning and installation
- One wire shelf standard, installed per door section.
- ACT solid state electronic control
- Environmentally friendly R290 refrigerant
- High density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low.
- 10' cord and plug supplied
- Three-year parts and labor warranty and a seven-year compressor parts warranty

Options & Accessories

- 18" wide single tier over shelf
- Stainless steel finish on back
- Cutting Boards
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height available
- Door lock
- Exterior thermometer (some models excluded)

Specifications

Exterior top is one-piece, 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. ST and STD models have standard backsplash, full width and 4" (10cm) tall.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel. Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of cabinet. Evaporator coil is located on the interior rear wall of cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior temperature of 33°F to 41°F (0°C to 4°C).

ACT control: ACT electronic, solid-state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connection is 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15 plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking brakes. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-guage stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable wire shelf.

Drawers have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Top drawer holds one full size 12" x 20", 4"-6" (30.5cm x 50.8cm x 10.2cm) deep pan, and three 1/6 size pans. Bottom drawer holds one full size 12" x 20" and three 1/6 size, 4" deep pans. Pans are supplied by others.

R290

4448NP Flat Top Refrigerated Bases

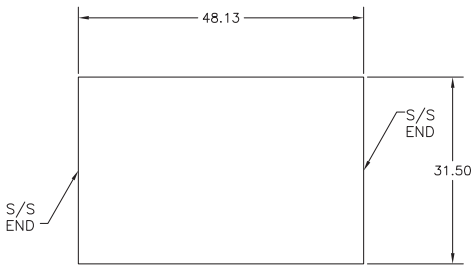
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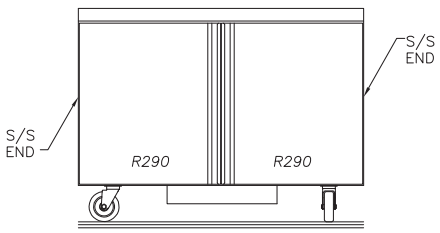
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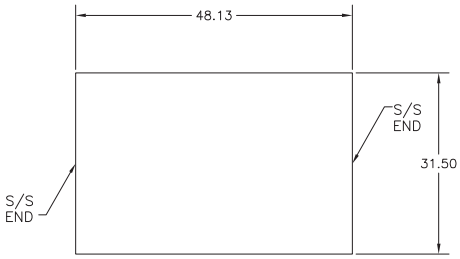
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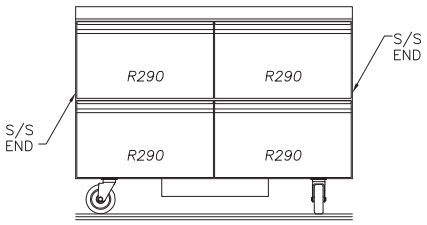
4448NP Flat Top Refrigerated Bases



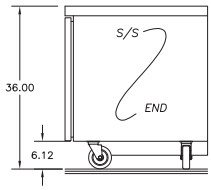


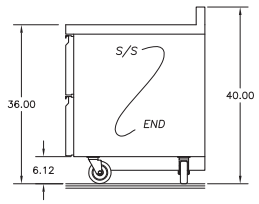
MODEL: 4448NP

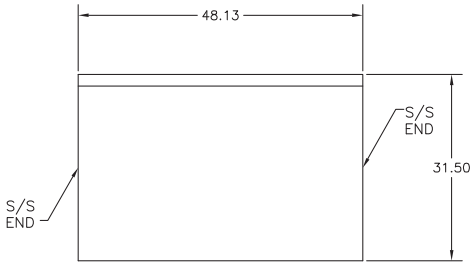


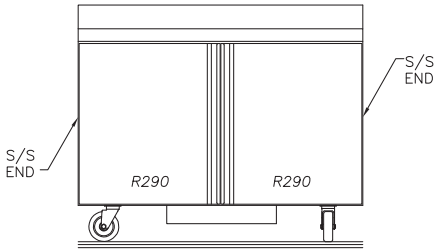


MODEL: D4448NP

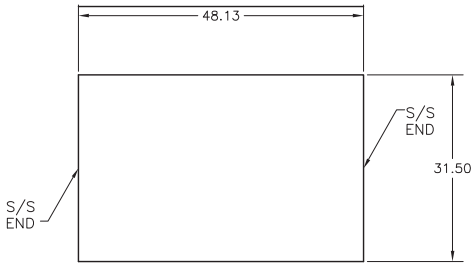


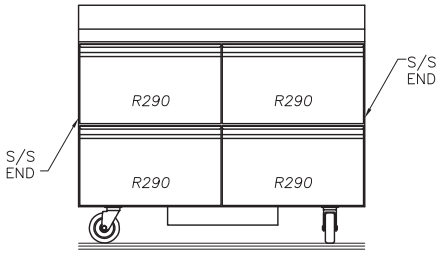






MODEL: ST4448NP





MODEL: STD4448NP

Specifications

Model	# of Shelves	Shelf Area	Storage Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
D4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg
ST4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
STD4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg

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Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

4448NP Mega Top

Front-Breathing Self-Contained Mega Top Refrigerated Bases

Models

- 4448NP-6M Two section with doors, six pan capacity
- D4448NP-6M Two section with drawers, six pan capacity
- 4448NP-12M Two section with doors, twelve pan capacity
- D4448NP-12M Two section with drawers, twelve pan capacity
- 4448NP-18M Two section with doors, eighteen pan capacity
- D4448NP-18M Two section with drawers, eighteen pan capacity



4448NP-18M
Shown with optional display in nosing.

Standard Features

- Patented air screen ensures product stays cold without drying it out
- 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet or an existing line up
- Durable, rugged stainless steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable - it won't dent, chip or corrode and is backed by a limited lifetime warranty
- Delfield supplies 1/6 size pans and positive placement adapter bars for top opening
- Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance
- Mega top refrigerators are standard with 8" wide, dishwasher safe polyethylene cutting board mounted on heavy-duty brackets
- "D" prefix models feature Delfield's drawer system. Drawers are backed by a 10-year warranty on the track assembly
- Environmentally friendly R290 refrigerant
- High density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low
- Bent in full length handle
- Standard on 5" casters for easy cleaning and installation
- 10' cord and plug supplied
- One epoxy coated wire shelf standard, installed per door section
- ACT solid state electronic control
- Three year parts and labor warranty and an additional two year compressor parts warranty

Options & Accessories

- Various lid options
- 18" wide single tier overshelf
- Stainless steel finish on back
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height
- Door lock
- Exterior thermometer

4448NP Mega Top

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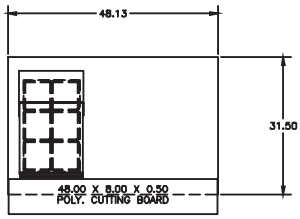
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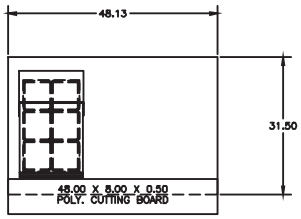
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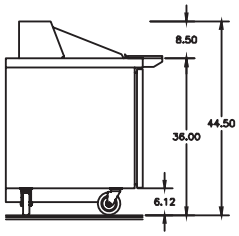
4448NP Mega Top

4448NP-6M Pan Cutout Configuration

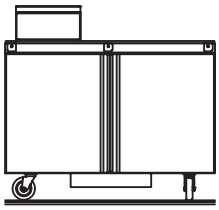


D4448NP-6M Pan Cutout Configuration

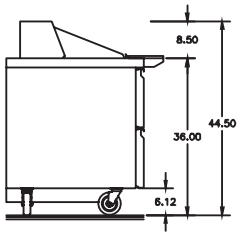




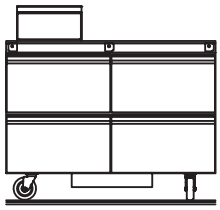
4448NP-6M Left Side View



4448NP-6M Elevation View

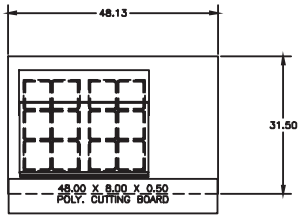


D4448NP-6M Left Side View

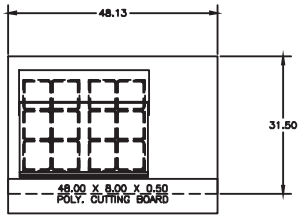


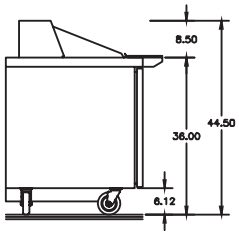
D4448NP-6M Elevation View

4448NP-12M Pan Cutout Configuration

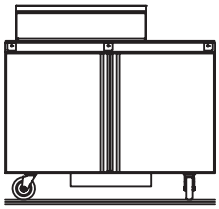


D4448NP-12M Pan Cutout Configuration

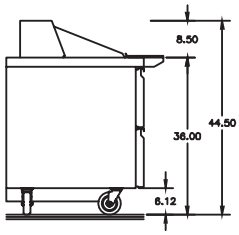




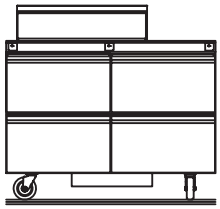
4448NP-12M Left Side View



4448NP-12M Elevation View



D4448NP-12M Left Side View



D4448NP-12M Elevation View

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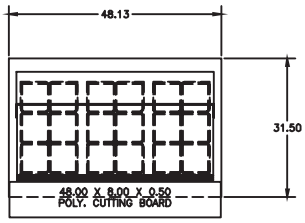
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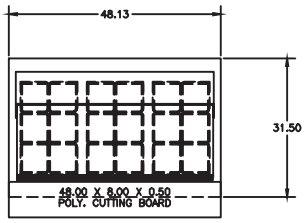
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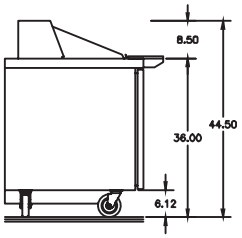
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4448NP-18M Pan Cutout Configuration

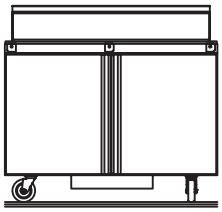


D4448NP-18M Pan Cutout Configuration

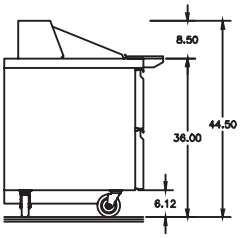




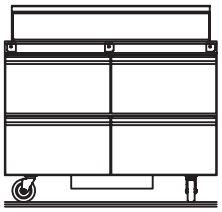
4448NP-18M
Left Side View



4448NP-18M
Elevation View



D4448NP-18M
Left Side View



D4448NP-18M
Elevation View

4448NP Mega Top

INSTALLATION NOTE:
Refrigeration system is designed so that air will flow under the unit, through the compressor area and out the front of the unit. Any restriction to this air flow path will void the warranties.

Specifications									
Model	1/6 Size Pan Cap.	# of Shelves	Shelf Area	Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP-6M	6	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-6M	6	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-12M	12	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-12M	12	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-18M	18	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-18M	18	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg

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Specifications

Exterior top is one-piece 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. Top of drawer unit has openings to accept eighteen 1/6 size plastic pans 4" (10cm) deep. Top of door unit has openings to accept eighteen 1/6 size plastic pans 4" or 6" (10cm or 15cm) deep. Adapter bars and 1/6 size pans are supplied by Delfield. Top has one telescoping lid is constructed of 20-gauge stainless steel. Temperature in top openings maintains 33°F (1°C) to 41°F (5°C), with pans recessed 2.5" (6.4cm) at 86°F ambient room temperature, meeting NSF 7 requirements. One 48" x 8" x .5" (121.9cm x 20.3cm x 1.3cm) polyethylene cutting board is mounted on the top at the front edge.

Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel.

Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high-density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of the cabinet. Evaporator coil is located on the interior rear wall of the cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior cabinet temperature of 33°F to 40°F (0°C to 4°C).

ACT control: ACT electronic, solid state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connections are 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15P plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable epoxy-coated wire shelf per door opening.

Drawers have 22-gauge stainless steel exterior with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Each top drawer will hold one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4"-6" (10.1cm-15.2cm) deep pans. Each bottom drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4" (10.1cm) deep pans. Pans are supplied by others.



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Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

4448NP Mega Top

Front-Breathing Self-Contained Mega Top Refrigerated Bases

Models

- 4448NP-6M Two section with doors, six pan capacity
- D4448NP-6M Two section with drawers, six pan capacity
- 4448NP-12M Two section with doors, twelve pan capacity
- D4448NP-12M Two section with drawers, twelve pan capacity
- 4448NP-18M Two section with doors, eighteen pan capacity
- D4448NP-18M Two section with drawers, eighteen pan capacity



4448NP-18M
Shown with optional display in nosing.

Standard Features

- Patented air screen ensures product stays cold without drying it out
- 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet or an existing line up
- Durable, rugged stainless steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable - it won't dent, chip or corrode and is backed by a limited lifetime warranty
- Delfield supplies 1/6 size pans and positive placement adapter bars for top opening
- Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance
- Mega top refrigerators are standard with 8" wide, dishwasher safe polyethylene cutting board mounted on heavy-duty brackets
- "D" prefix models feature Delfield's drawer system. Drawers are backed by a 10-year warranty on the track assembly
- Environmentally friendly R290 refrigerant
- High density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low
- Bent in full length handle
- Standard on 5" casters for easy cleaning and installation
- 10' cord and plug supplied
- One epoxy coated wire shelf standard, installed per door section
- ACT solid state electronic control
- Three year parts and labor warranty and an additional two year compressor parts warranty

Options & Accessories

- Various lid options
- 18" wide single tier overshelf
- Stainless steel finish on back
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height
- Door lock
- Exterior thermometer

4448NP Mega Top

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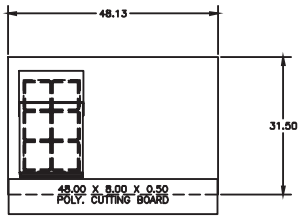
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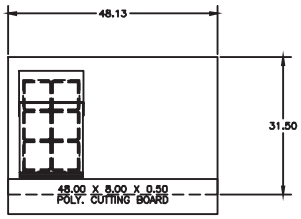
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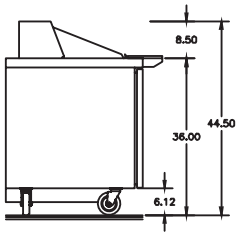
4448NP Mega Top

4448NP-6M Pan Cutout Configuration

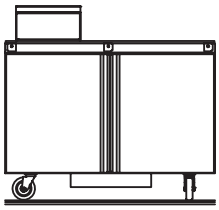


D4448NP-6M Pan Cutout Configuration

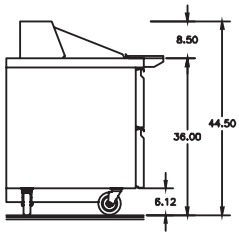




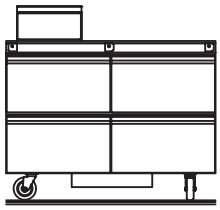
4448NP-6M Left Side View



4448NP-6M Elevation View

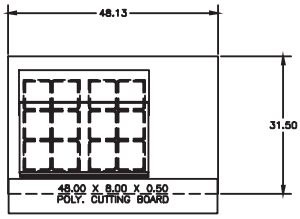


D4448NP-6M Left Side View

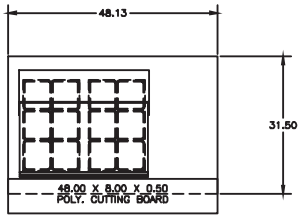


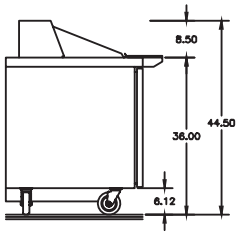
D4448NP-6M Elevation View

4448NP-12M Pan Cutout Configuration

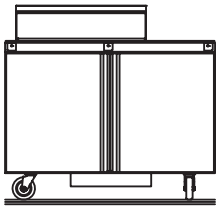


D4448NP-12M Pan Cutout Configuration

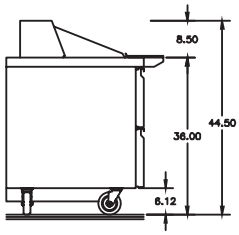




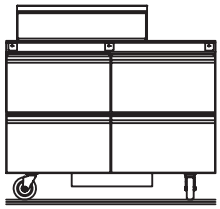
4448NP-12M Left Side View



4448NP-12M Elevation View



D4448NP-12M Left Side View



D4448NP-12M Elevation View

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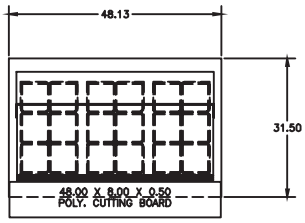
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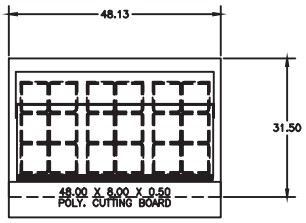
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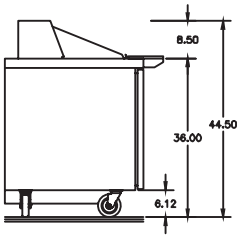
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4448NP-18M Pan Cutout Configuration

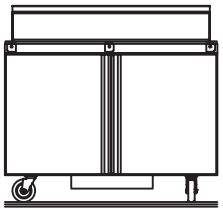


D4448NP-18M Pan Cutout Configuration

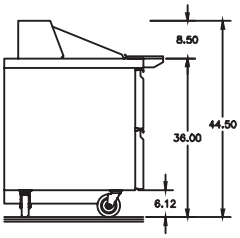




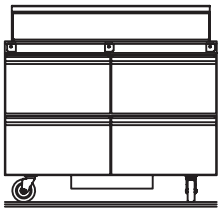
4448NP-18M
Left Side View



4448NP-18M
Elevation View



D4448NP-18M
Left Side View



D4448NP-18M
Elevation View

4448NP Mega Top

INSTALLATION NOTE:
Refrigeration system is designed so that air will flow under the unit, through the compressor area and out the front of the unit. Any restriction to this air flow path will void the warranties.

Specifications									
Model	1/6 Size Pan Cap.	# of Shelves	Shelf Area	Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP-6M	6	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-6M	6	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-12M	12	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-12M	12	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-18M	18	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-18M	18	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg

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Specifications

Exterior top is one-piece 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. Top of drawer unit has openings to accept eighteen 1/6 size plastic pans 4" (10cm) deep. Top of door unit has openings to accept eighteen 1/6 size plastic pans 4" or 6" (10cm or 15cm) deep. Adapter bars and 1/6 size pans are supplied by Delfield. Top has one telescoping lid is constructed of 20-gauge stainless steel. Temperature in top openings maintains 33°F (1°C) to 41°F (5°C), with pans recessed 2.5" (6.4cm) at 86°F ambient room temperature, meeting NSF 7 requirements. One 48" x 8" x .5" (121.9cm x 20.3cm x 1.3cm) polyethylene cutting board is mounted on the top at the front edge.

Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel.

Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high-density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of the cabinet. Evaporator coil is located on the interior rear wall of the cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior cabinet temperature of 33°F to 40°F (0°C to 4°C).

ACT control: ACT electronic, solid state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connections are 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15P plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable epoxy-coated wire shelf per door opening.

Drawers have 22-gauge stainless steel exterior with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Each top drawer will hold one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4"-6" (10.1cm-15.2cm) deep pans. Each bottom drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4" (10.1cm) deep pans. Pans are supplied by others.



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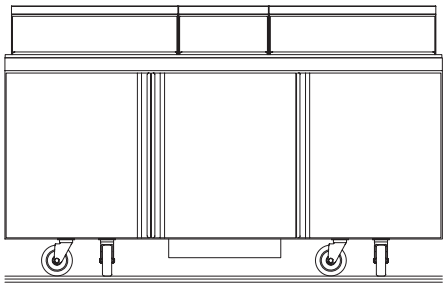
Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

4472NP Mega Top

Front-Breathing Self-Contained Mega Top Refrigerated Bases

Models

• 4472NP-18M	Three section with doors, eighteen pan capacity
• D4472NP-18M	Three section with drawers, eighteen pan capacity
• 4472NP-24M	Three section with doors, twenty-four pan capacity
• D4472NP-24M	Three section with drawers, twenty-four pan capacity
• 4472NP-30M	Three section with doors, thirty pan capacity
• D4472NP-30M	Three section with drawers, thirty pan capacity



4472NP-30M

Standard Features

- Patented air screen ensures product stays cold without drying it out
- All 4400 Series units are 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet or an existing line up
- Durable, rugged stainless steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable - it won't dent, chip or corrode and is backed by a limited lifetime warranty
- Delfield supplies 1/6 size pans and positive placement adapter bars for top opening
- Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance
- Mega top refrigerators are standard with 8" wide, dishwasher safe polyethylene cutting board mounted on heavy-duty brackets
- "D" prefix models feature Delfield's new drawer system. Drawers are backed by a 10-year warranty on the track assembly
- Environmentally friendly R290 refrigerant
- High density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low
- Bent in full length handle
- Standard on 5" casters for easy cleaning and installation
- 10' cord and plug supplied
- One epoxy coated wire shelf standard, installed per door section
- ACT solid state electronic control
- Three year parts and labor warranty and an additional two year compressor parts warranty

Options & Accessories

- Various lid options
- 18" wide single tier overshelf
- Stainless steel finish on back
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height
- Door lock
- Exterior thermometer

4472NP Mega Top

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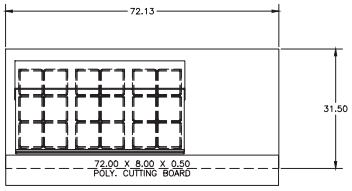
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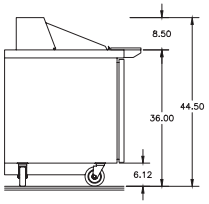
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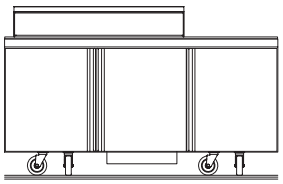
4472NP-18M

4472NP-18M Pan Cutout Configuration





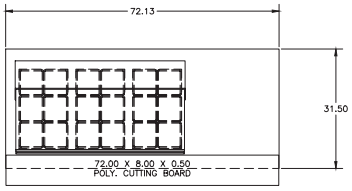
4472NP-18M Right Side View

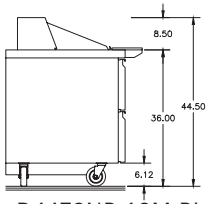


4472NP-18M Elevation View

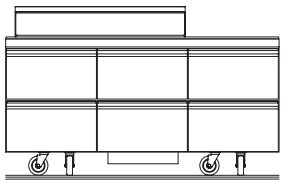
D4472NP-18M

D4472NP-18M Pan Cutout Configuration





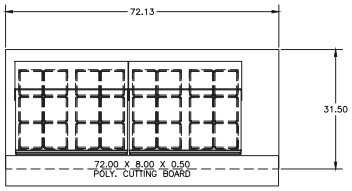
D4472NP-18M Right Side View

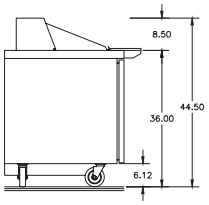


D4472NP-18M Elevation View

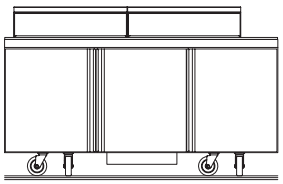
4472NP-24M

4472NP-24M Pan Cutout Configuration





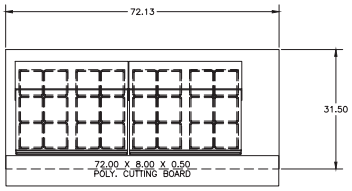
4472NP-24M Right Side View

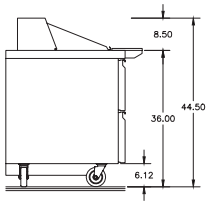


4472NP-24M Elevation View

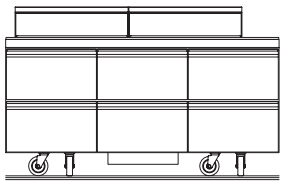
D4472NP-24M

D4472NP-24M Pan Cutout Configuration





D4472NP-24M Right Side View



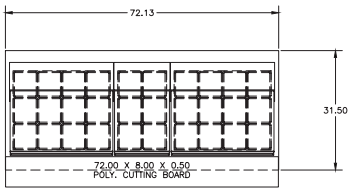
D4472NP-24M Elevation View

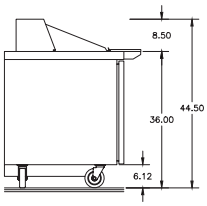
WELBILT®

DELFIELD®

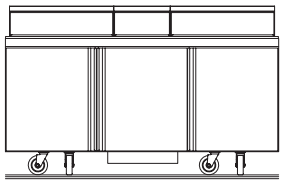
4472NP-30M

4472NP-30M Pan Cutout Configuration





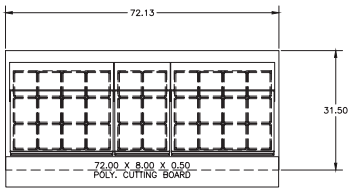
4472NP-30M
Right Side View

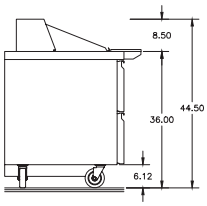


4472NP-30M
Elevation View

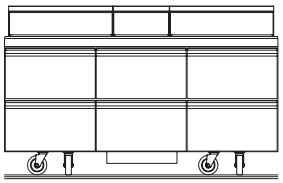
D4472NP-30M

D4472NP-30M Pan Cutout Configuration





D4472NP-30M
Right Side View



D4472NP-30M
Elevation View

INSTALLATION NOTE:
Refrigeration system is designed so that air will flow under the unit, through the compressor area and out the front of the unit. Any restriction to this air flow path will void the warranties.

4472NP Mega Top

Specifications									
Model	1/6 Size Pan Cap.	# of Shelves	Shelf Area	Volume	H.P.	V/Hz/Ph	Amps	Nema Plug	Ship Weight
4472NP-18M	18	3	8.22ft2	24.80ft3	.35	115/60/1	6.0	5-15P	461lbs/209kg
D4472NP-18M	18	N/A	N/A	24.80ft3	.35	115/60/1	6.0	5-15P	545lbs/247kg
4472NP-24M	24	3	8.22ft2	24.80ft3	.35	115/60/1	6.0	5-15P	461lbs/209kg
D4472NP-24M	24	N/A	N/A	24.80ft3	.35	115/60/1	6.0	5-15P	545lbs/247kg
4472NP-30M	30	3	8.22ft2	24.80ft3	.35	115/60/1	6.0	5-15P	461lbs/209kg
D4472NP-30M	30	N/A	N/A	24.80ft3	.35	115/60/1	6.0	5-15P	545lbs/247kg

WELBILT®

DELFIELD®

Specifications

Exterior top is one-piece 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. Telescoping lid is constructed of 20-gauge stainless steel. Top of drawer unit has openings to accept 18, 24 or 30 1/6 size plastic pans 4" (10cm) deep. Top of door unit has openings to accept 18, 24 or 30 1/6 size plastic pans 4" or 6" (10cm or 15cm) deep. Adapter bars and 1/6 size pans are supplied by Delfield. Temperature in top openings maintains 33°F (1°C) to 41°F (5°C), with pans recessed 2.5" (6.4cm) at 86°F ambient room temperature, meeting NSF 7 requirements. One 72" x 8" x .5" (183cm x 20.3cm x 1.3cm) polyethylene cutting board is mounted on the top at the front edge.

Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel.

Interior sides are thermoformed ABS plastic with shelf supports. Base is fully insulated with high-density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses R290 refrigerant. Compressor is .35 H.P., with condenser coil and hot gas condensate evaporator mounted on rear of the cabinet. Evaporator coil is located on the interior rear wall of the cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior cabinet temperature of 36°F to 40°F (2°C to 4°C).

ACT control: ACT electronic, solid state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connections are 115 volt, 60 Hertz, single phase. Unit has a 10' (3.3m) long electrical cord and NEMA 5-15P plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable epoxy-coated wire shelf per door opening.

Drawers have 22-gauge stainless steel exterior with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Each top drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size pans 4"-6" (10.2cm-15.2cm) deep. Each bottom drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size pans 4" (10.1cm) deep. Pans are supplied by others.

R290

4472NP Mega Top

Welbilt reserves the right to make changes to the design or specifications without prior notice.

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948
Fax: 800-669-0619

www.delfield.com
7077_4472NP-M
01/19

WELBILT®

200-HW Series
Waterless Hot Food Well

Unlike traditional steam tables or dry wells, waterless hot food wells from Alto-Shaam feature radiant Halo Heat® technology that evenly surrounds food without the use of extremely hot elements, added humidity or fans. Extend hold times, maintain food quality and reduce operating costs to maximize return on investment.



200-HW/D4

Standard Features

- Extend food holding times with efficient, precise Halo Heat® technology
- Maintain food quality without the use of extremely hot elements, added humidity or fans
- Increase sales with attractive food presentation and quality
- Reduce installation and operating costs with no water or plumbing needed
- Save on maintenance costs, eliminating lime and scale buildup associated with traditional steam tables
- Increase employee and customer safety with elimination of hot water and steam
- Provide optimal holding temperatures with an adjustable thermostat that can be flush-mounted into the counter or a location out of sight from customers
- Set ideal holding temperatures for any dish with an individual well control option
- HWLF models feature a large flange
- HWI and HWILF models are controlled by two (2) separate adjustable thermostats
- 200-HW/D4, 200-HW/D6, 200-HWLF/D4, and 200-HWLF/D6 models include four (4) half/third-size divider bars and one (1) large pan divider bar
- 200-HW/D443 and 200-HW/D643 models include six (6) third-size divider bars and one (1) large pan divider bar
- 200-HWI/D4, 200-HWI/D6, 200-HWILF/D4, and 200-HWILF/D6 models include four (4) half/third-size divider bars
- 200-HWI/D443 and 200-HWI/D643 models include six (6) third-size divider bars

Configurations (select one)

- ☐ 200-HW/D4
- ☐ 200-HW/D6
- ☐ 200-HW/D443
- ☐ 200-HW/D643
- ☐ 200-HWLF/D4
- ☐ 200-HWLF/D6
- ☐ 200-HWI/D4
- ☐ 200-HWI/D6
- ☐ 200-HWI/D443
- ☐ 200-HWI/D643
- ☐ 200-HWILF/D4
- ☐ 200-HWILF/D6

Electrical

- ☐ 120V
- ☐ 208–240V
- ☐ 230V

Control box cord location

- ☐ Back, standard
- ☐ Bottom, optional

Accessories (select all that apply)

- ☐ Pan divider bar—half-size/third-size (11318)
- ☐ Pan divider bar—full-size (16019)
- ☐ Pan divider bar—D443/D643 size (1012405)
- ☐ Locking kit (5020849)

CAPACITY

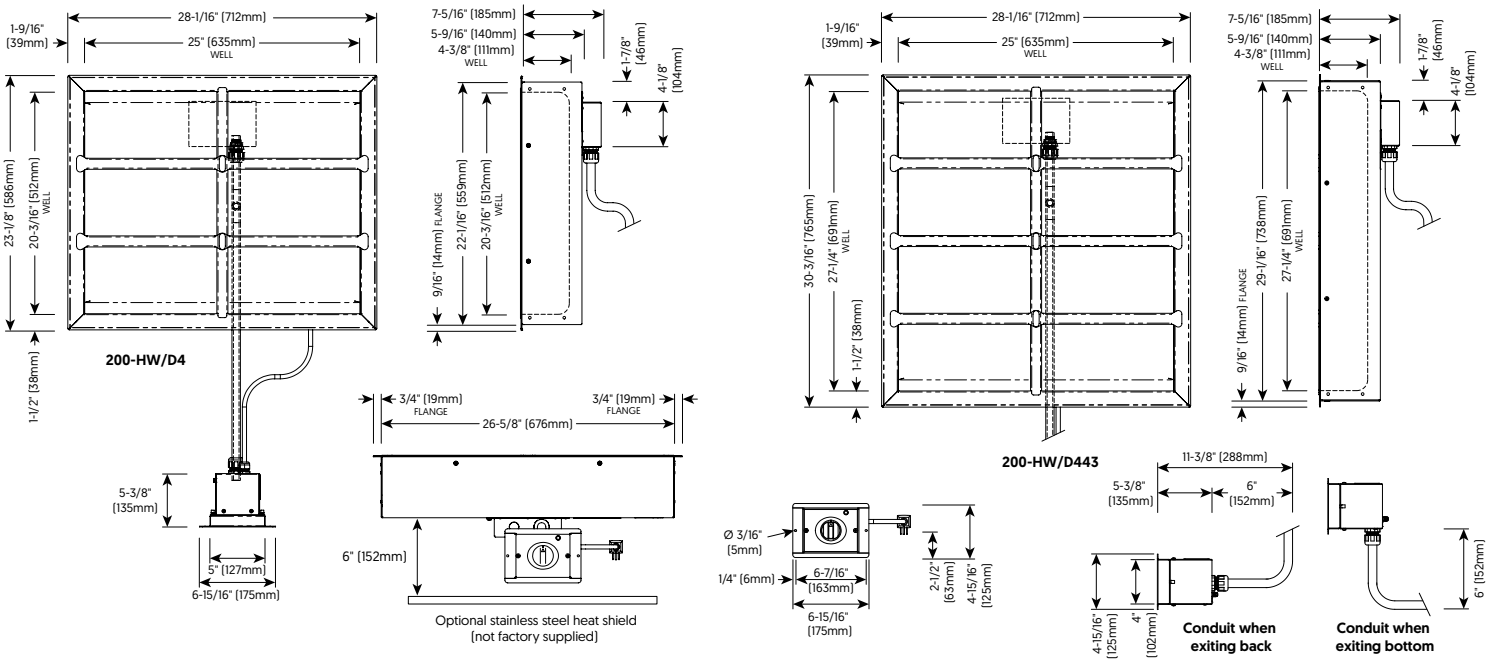
2
4
6
8

- Two full-size of GN 1/1 pans
- Four half-size or GN 1/2 pans
- D4, D6: Six third-size or GN 1/3 pans
- D443, D643: Eight third-size or GN 1/3 pans
- D4: 48 lb (23 kg) product maximum; 29 qt (28 L) volume maximum
- D6: 72 lb (33 kg) product maximum; 44 qt (42 L) volume maximum
- D443: 63 lb (29 kg) product maximum; 37.8 qt (35,5 L) volume maximum
- D643: 96 lb (44 kg) product maximum; 57.3 qt (53,5 L) volume maximum

IP X3

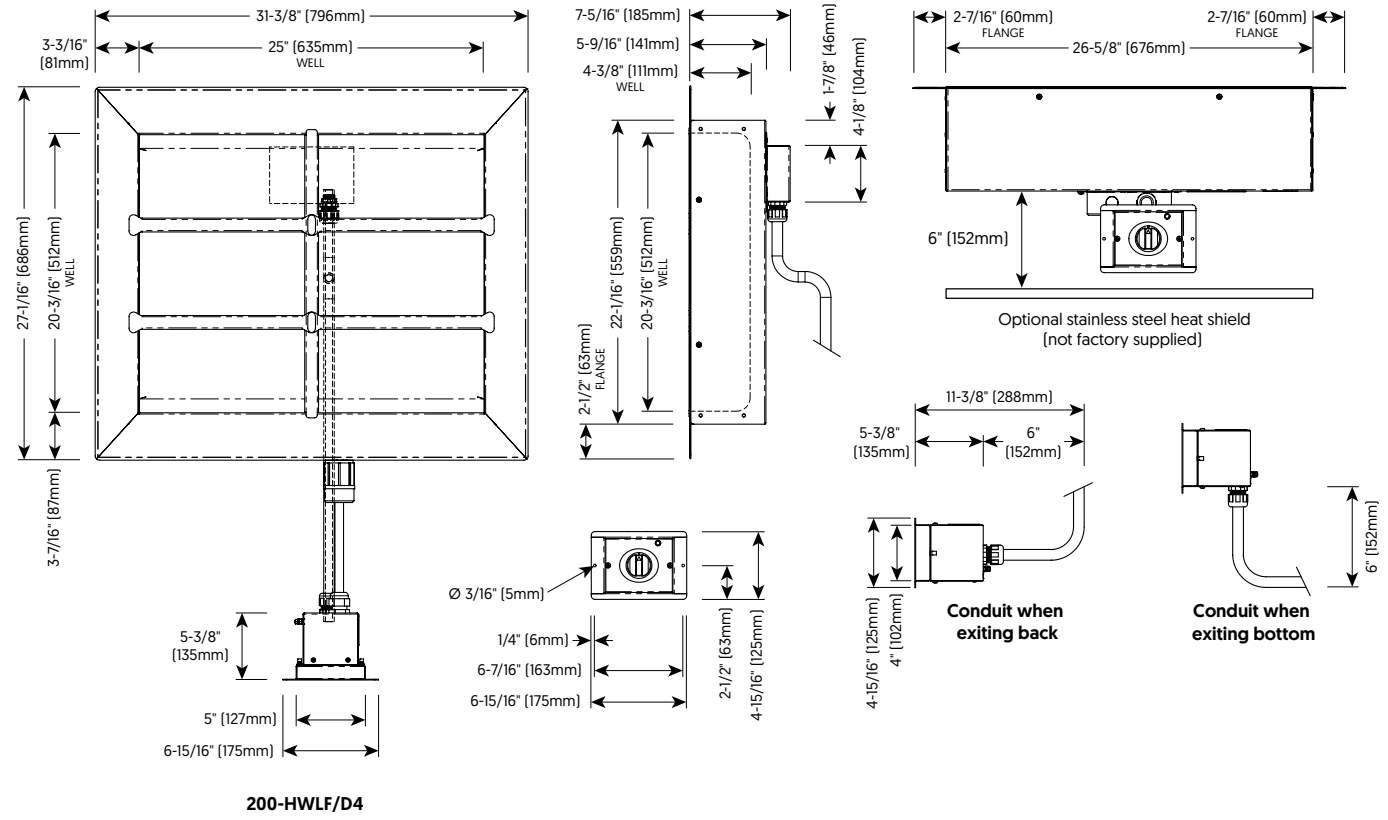
200-HW Series

Specification



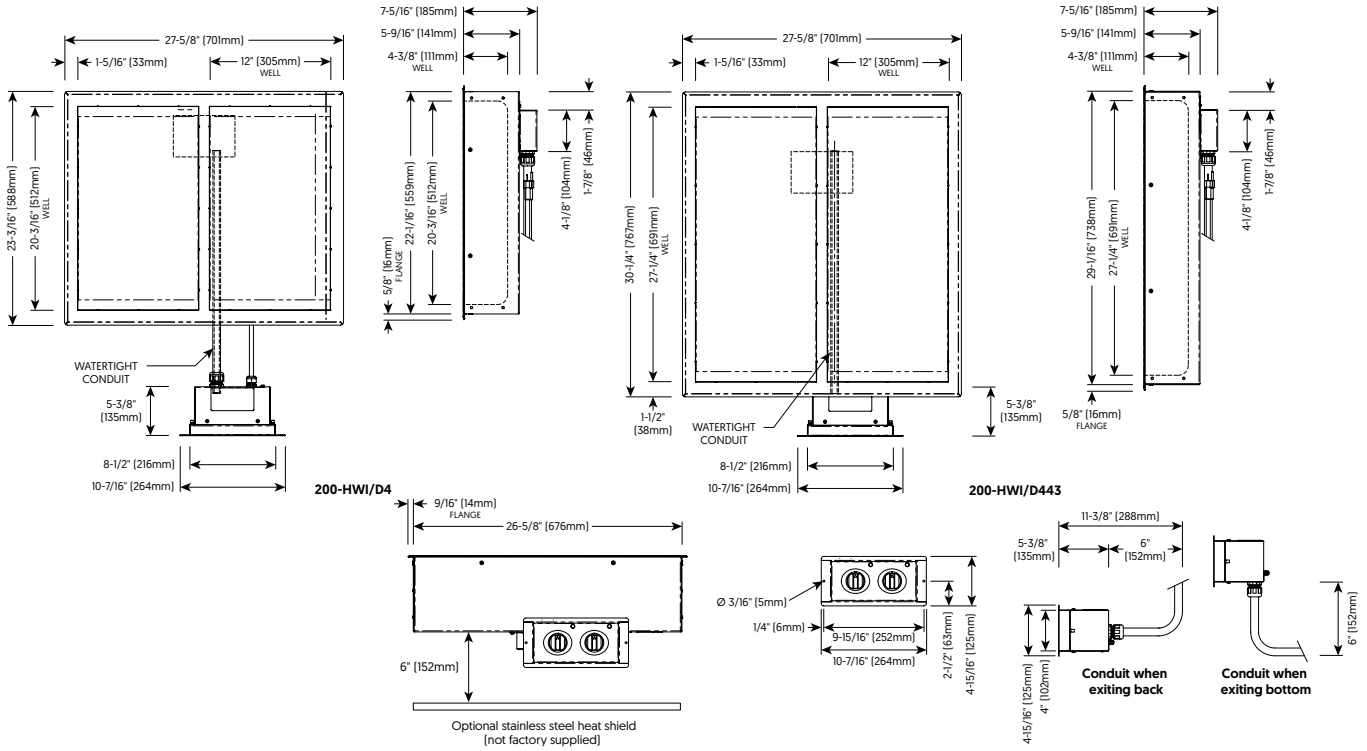
200-HWLF Series

Specification



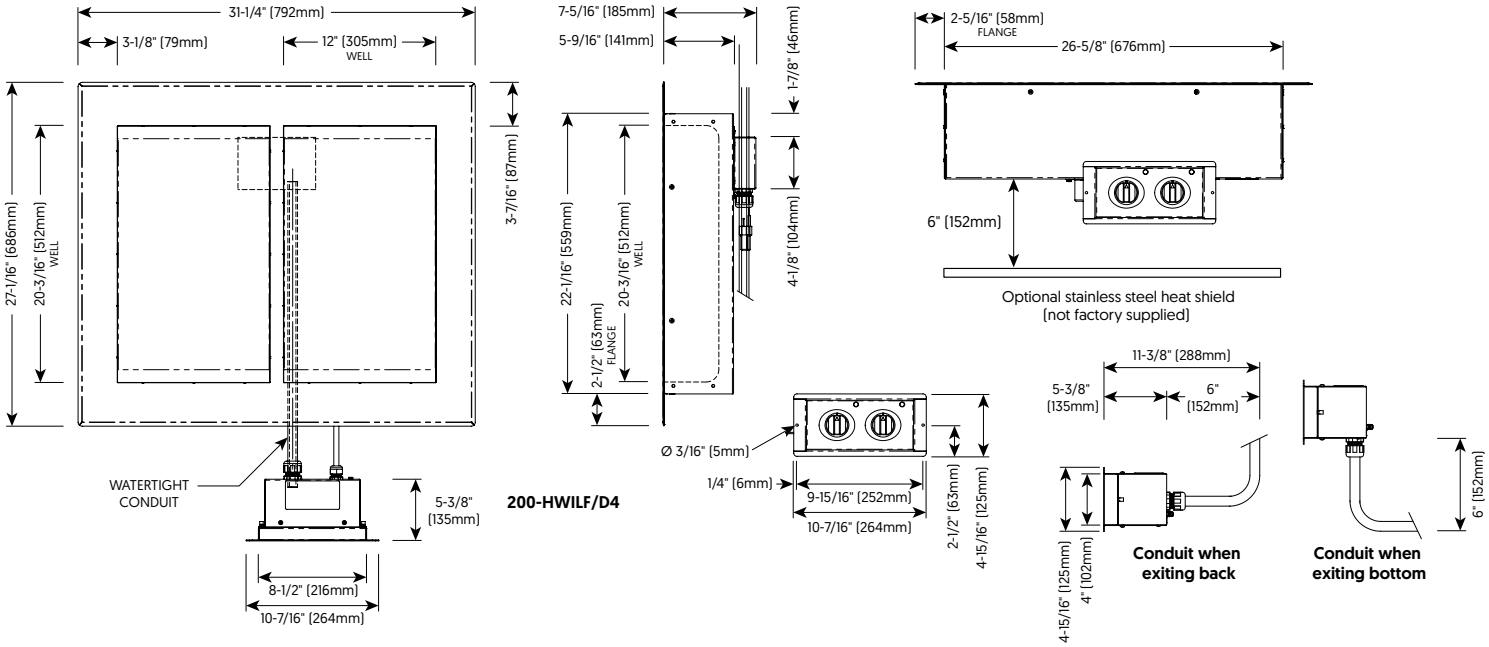
200-HWI Series

Specification



200-HWILF Series

Specification



200-HW Series

ALTO-SHAAM



DIMENSIONS

Model	Exterior (H x W x D)	Interior (H x W x D)
200-HW/D4	7-5/16" x 28-1/16" x 23-1/8" (185mm x 712mm x 586mm)	4-3/8" x 25" x 20-3/16" (111mm x 635mm x 512mm)
200-HW/D6	9-5/16" x 28-1/16" x 23-1/8" (235mm x 712mm x 586mm)	6-3/8" x 25" x 20-3/16" (162mm x 635mm x 512mm)
200-HW/D443	7-5/16" x 28-1/16" x 30-3/16" (185mm x 712mm x 765mm)	4-3/8" x 12" x 27-1/4" (111mm x 304mm x 691mm)
200-HW/D643	9-3/16" x 28-1/16" x 30-3/16" (233mm x 712mm x 765mm)	6-3/8" x 12" x 27-1/4" (162mm x 304mm x 691mm)
200-HWLF/D4	7-5/16" x 31-3/8" x 27-1/16" (185mm x 796mm x 686mm)	4-3/8" x 25" x 20-3/16" (111mm x 635mm x 512mm)
200-HWLF/D6v	9-1/4" x 31-3/8" x 27-1/16" (234mm x 796mm x 686mm)	6-3/8" x 25" x 20-3/16" (162mm x 635mm x 512mm)
200-HWI/D4	7-5/16" x 27-5/8" x 23-3/16" (185mm x 701mm x 588mm)	4-3/8" x 12" x 20-3/16" (111mm x 304mm x 512mm)
200-HWI/D6	9-5/16" x 27-5/8" x 23-3/16" (235mm x 701mm x 586mm)	6-3/8" x 12" x 20-3/16" (162mm x 304mm x 512mm)
200-HWI/D443	7-5/16" x 27-5/8" x 30-1/4" (185mm x 701mm x 767mm)	4-3/8" x 12" x 27-1/4" (111mm x 304mm x 691mm)
200-HWI/D643	9-1/4" x 27-5/8" x 30-1/4" (234mm x 701mm x 767mm)	6-3/8" x 12" x 27-1/4" (162mm x 304mm x 691mm)
200-HWILF/D4	7-5/16" x 31-1/4" x 27-1/16" (185mm x 792mm x 686mm)	4-3/8" x 12" x 20-3/16" (111mm x 304mm x 512mm)
200-HWILF/D6	9-5/16" x 31-1/4" x 27-1/16" (225mm x 792mm x 686mm)	6-3/8" x 12" x 20-3/16" (162mm x 304mm x 512mm)

Model	Net Weight	Ship Weight**	Ship Dimensions (L x W x H)**
200-HW/D4	40 lb (18 kg)	115 lb (52 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HW/D6	45.5 lb (21 kg)	110 lb (50 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HW/D443	50 lb (23 kg)	Contact factory	Contact factory
200-HW/D643	56 lb (25 kg)	120 lb (54 kg)	40" x 32" x 15" (1016mm x 813mm x 381mm)
200-HWLF/D4	43 lb (20 kg)	100 lb (45 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HWLF/D6	48 lb (22 kg)	110 lb (50 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HWI/D4	50 lb (23 kg)	120 lb (54 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HWI/D6	56.25 lb (26 kg)	116 lb (53 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HWI/D443	62 lb (28 kg)	Contact factory	Contact factory
200-HWI/D643	69.5 lb (32 kg)	120 lb (54 kg)	35" x 35" x 26" (889mm x 889mm x 660mm)
200-HWILF/D4	54.25 lb (25 kg)	100 lb (45 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)
200-HWILF/D6	60.5 lb (27 kg)	110 lb (50 kg)	35" x 35" x 19" (889mm x 889mm x 483mm)

**Domestic ground shipping information. Contact factory for export weight and dimensions.

Cutout Dimensions

Model	Non-combustible Surface Cutout (L x W)	Combustible Surface Cutout (L x W)^	Control Box Cutout (H x W x D)*
200-HW/D4	26-13/16" x 22-1/8" (681mm x 562mm)	---	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HW/D6	26-13/16" x 22-1/8" (681mm x 562mm)	---	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HW/D443	26-13/16" x 29-1/8" (681mm x 740mm)	---	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HW/D643	26-13/16" x 29-1/8" (681mm x 740mm)	---	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HWLF/D4	26-13/16" x 22-1/8" (681mm x 562mm)	28-13/16" x 24-1/16" (732mm x 611mm)	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HWLF/D6	26-13/16" x 22-1/8" (681mm x 562mm)	28-13/16" x 24-1/16" (732mm x 611mm)	4-1/4" x 5-1/4" x 11-3/8" (108mm x 133mm x 288mm)
200-HWI/D4	26-13/16" x 22-1/8" (681mm x 562mm)	---	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)
200-HWI/D6	26-13/16" x 22-1/8" (681mm x 562mm)	---	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)
200-HWI/D443	26-13/16" x 29-1/8" (681mm x 740mm)	---	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)
200-HWI/D643	26-13/16" x 29-1/8" (681mm x 740mm)	---	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)
200-HWILF/D4	26-13/16" x 22-1/8" (681mm x 562mm)	28-13/16" x 24-1/16" (732mm x 611mm)	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)
200-HWILF/D6	26-13/16" x 22-1/8" (681mm x 562mm)	28-13/16" x 24-1/16" (732mm x 611mm)	4-1/4" x 8-3/4" x 11-3/8" (108mm x 222mm x 288mm)

^Large flange wells only.

*Allow 6" (152mm) clearance from control box to conduit bend.



CHECK FIRST

- Appliance must be installed level and must not be installed in any area where it may be directly affected by steam, grease, dripping water, high temperatures, or any other severely adverse conditions.
- Some foods may require additional overhead heating. Always monitor the food temperature and add overhead heating when needed.
- Countertop material must withstand temperatures up to 200°F (93°C).
- A stainless steel heat shield is recommended if the area under the appliance is used for storage.

200-HW Series

ALTO-SHAAM

HEAT

Heat of rejection

200-HW	Heat Gain qs, BTU/hr	Heat Gain qs, kW
	162	0.05

CLEARANCE

1" (25 mm) from combustible surfaces

ELECTRIC

Model		V	Ph	Hz	A	kW	Cord & Plug
200-HW/D4 and /D6, 200-HWLF/D4 and /D6, 200-HWI/D4 and /D6, 200-HWILF/D4 and /D6	120V	120	1	50/60	10.0	1.2	NEMA 5-15p 15A-125V plug
	208–240V	208	1	50/60	4.3	0.9	NEMA 6-15p 15A-250V plug (U.S.A. only)
		240	1	50/60	5.0	1.2	
	230V	230	1	50/60	5.2	1.2	CEE 7/7 plug rated 250V CH2-16p plug rated 250V BS 1363 (U.K. only) plug rated 250V
200-HW/D443, 200-HW/D643, 200-HWI/D443, 200-HWI/D643	120V	120	1	50/60	13.5	1.6	NEMA 5-20p 15A-125V plug
	208–240V	208	1	50/60	5.8	1.6	NEMA 6-15p 15A-250V plug (U.S.A. only)
		240	1	50/60	6.8	1.6	
	230V	230	1	50/60	6.5	1.6	CEE 7/7 plug rated 250V CH2-16p plug rated 250V BS 1363 (U.K. only) plug rated 250V
Cord length: 120V: 6 ft (1.8 m); 208–240V: 9 ft (2.7 m); 230V (CEE): 9 ft (2.7 m); 230V (CH, BS): 8 ft (2.5 m)							

CONTACT US

W164 N9221 Water Street | Menomonee Falls, Wisconsin 53051 | U.S.A.
Phone: 262.251.3800 | 800.558.8744 U.S.A./Canada | Fax: 262.251.7067 | alto-shaam.com

HW-SPC-0003 - 02/21 Printed in U.S.A. Due to ongoing product improvement, specifications are subject to change without notice.

SPEC SHEET

"ST6R5-SSK" STAINLESS STEEL TOP WORK TABLES

16GA Top w/5" Riser & Stainless Steel Legs & Adjustable Undershelf

FEATURES:

- 16GA Stainless Steel Top w/5" Riser & Turndown
- Type 300 Stainless Steel With #4 Polish, Satin Finish
- Top Is Sound Deadened
- Reinforced With 1"x2" Channel Running Entire Length Of Table
- 1-1/2" Stallion Edge On Front Side Edges 90 Degree Bend Down For Table Line-Up
- Stainless Steel Base With Adjustable Undershelf
- Adjustable Bullet Feet
- Ships Knocked-Down Easy-To-Assemble

SPECIFICATIONS:

- Top: Stainless Steel Tops Are TIG Welded, Exposed Welds Are Polished To Match Adjacent Surface
- Top: 16GA Stainless Steel Type 300 Stainless Steel With #4 Polish, Satin Finish
- Shelf: 18GA Stainless Steel, (36" Wide Tables, 16 GA Lower Shelf)
- Legs: 1-5/8" Round O.D. 16GA Tubular Stainless Steel
- Gussets: Stainless Steel
- Feet: 1" Adjustable Stainless Bullet Feet

CERTIFICATIONS:



ST6R5-3048SSK

ACCESSORIES

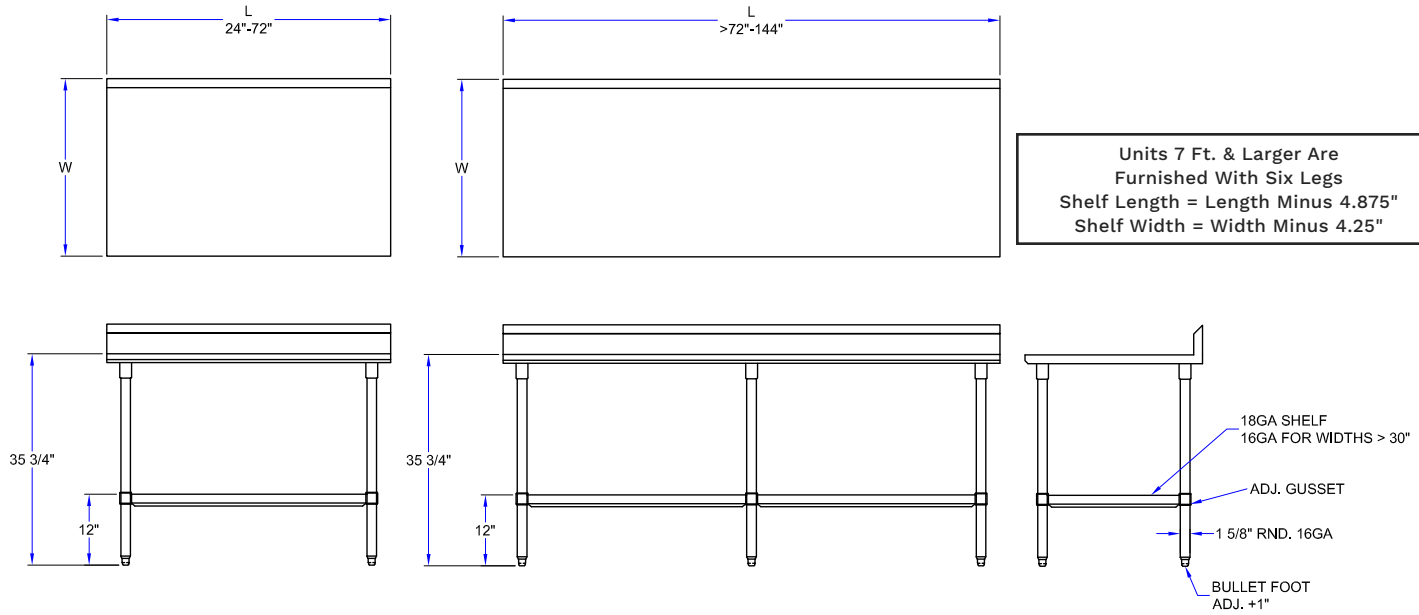
DESCRIPTION
Drawer
Drawer Lock
Casters
Overshelves
Sinks
Pot Rack

"ST6R5-SSK" STAINLESS STEEL TOP WORK TABLES

LENGTH	24" WIDE	WT	WT CAP	30" WIDE	WT	WT CAP	36" WIDE	WT	WT CAP
24"	**ST6R5-2424SSK**	44	900	**ST6R5-3024SSK**	49	900	**ST6R5-3624SSK**	58	900
30"	**ST6R5-2430SSK**	49	900	**ST6R5-3030SSK**	54	900	**ST6R5-3630SSK**	68	900
36"	**ST6R5-2436SSK**	55	900	**ST6R5-3036SSK**	62	900	**ST6R5-3636SSK**	75	900
48"	**ST6R5-2448SSK**	67	900	**ST6R5-3048SSK**	77	900	**ST6R5-3648SSK**	93	900
60"	**ST6R5-2460SSK**	80	610	**ST6R5-3060SSK**	91	610	**ST6R5-3660SSK**	111	610
72"	**ST6R5-2472SSK**	92	400	**ST6R5-3072SSK**	105	400	**ST6R5-3672SSK**	129	400
84"	**ST6R5-2484SSK**	111	1350	**ST6R5-3084SSK**	127	1350	**ST6R5-3684SSK**	159	1350
96"	**ST6R5-2496SSK**	123	1350	**ST6R5-3096SSK**	142	1350	**ST6R5-3696SSK**	177	1350
108"	**ST6R5-24108SSK**	136	1350	**ST6R5-30108SSK**	155	1350	**ST6R5-36108SSK**	193	1350
120"	**ST6R5-24120SSK**	147	1130	**ST6R5-30120SSK**	170	1130	**ST6R5-36120SSK**	211	1130
132"	**ST6R5-24132SSK**	159	900	**ST6R5-30132SSK**	184	900	**ST6R5-36132SSK**	228	900
144"	**ST6R5-24144SSK**	171	680	**ST6R5-30144SSK**	199	680	**ST6R5-36144SSK**	246	680

OVERALL WEIGHT (WT) AND MAX WEIGHT CAPACITY (WT CAP) ARE IN POUNDS (LBS). MAX WEIGHT CAPACITY EVENLY DISTRIBUTED.
ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

DETAILED SPECIFICATIONS



MODEL # STRUCTURE

5 = Ht. Of Riser w/Turndown
R = Top w/Riser
6 = 16GA Work Surface
ST = Stainless Steel Top

24 = Width Of Work Surface
30 = Length Of Work Surface
SS = Stainless Legs & Shelf
K = Ships Knocked Down

ST6R5-2430SSK

"ST6R5-SSK" STAINLESS STEEL TOP WORK TABLES

LENGTH	24" WIDE	WT	WT CAP	30" WIDE	WT	WT CAP	36" WIDE	WT	WT CAP
24"	ST6R5-2424SSK	44	900	ST6R5-3024SSK	49	900	ST6R5-3624SSK	58	900
30"	ST6R5-2430SSK	49	900	ST6R5-3030SSK	54	900	ST6R5-3630SSK	68	900
36"	ST6R5-2436SSK	55	900	ST6R5-3036SSK	62	900	ST6R5-3636SSK	75	900
48"	ST6R5-2448SSK	67	900	ST6R5-3048SSK	77	900	ST6R5-3648SSK	93	900
60"	ST6R5-2460SSK	80	610	ST6R5-3060SSK	91	610	ST6R5-3660SSK	111	610
72"	ST6R5-2472SSK	92	400	ST6R5-3072SSK	105	400	ST6R5-3672SSK	129	400
84"	ST6R5-2484SSK	111	1350	ST6R5-3084SSK	127	1350	ST6R5-3684SSK	159	1350
96"	ST6R5-2496SSK	123	1350	ST6R5-3096SSK	142	1350	ST6R5-3696SSK	177	1350
108"	ST6R5-24108SSK	136	1350	ST6R5-30108SSK	155	1350	ST6R5-36108SSK	193	1350
120"	ST6R5-24120SSK	147	1130	ST6R5-30120SSK	170	1130	ST6R5-36120SSK	211	1130
132"	ST6R5-24132SSK	159	900	ST6R5-30132SSK	184	900	ST6R5-36132SSK	228	900
144"	ST6R5-24144SSK	171	680	ST6R5-30144SSK	199	680	ST6R5-36144SSK	246	680

OVERALL WEIGHT (WT) AND MAX WEIGHT CAPACITY (WT CAP) ARE IN POUNDS (LBS). MAX WEIGHT CAPACITY EVENLY DISTRIBUTED.
ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

SPEC SHEET

"EWS8" WALL SHELVES

Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
- 1-1/2" Turned Up Backsplash
- 12" Or 16" Depth
- Shipped Knocked-Down, Easy-To-Assemble
- All Models Are NSF Certified

SPECIFICATIONS:

- Stainless Steel Shelves Are TIG Welded
- Exposed Welds Are Polished To Match Adjacent Surface
- Shelf: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish
- Brackets: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish



EWS8-1636

CERTIFICATIONS:

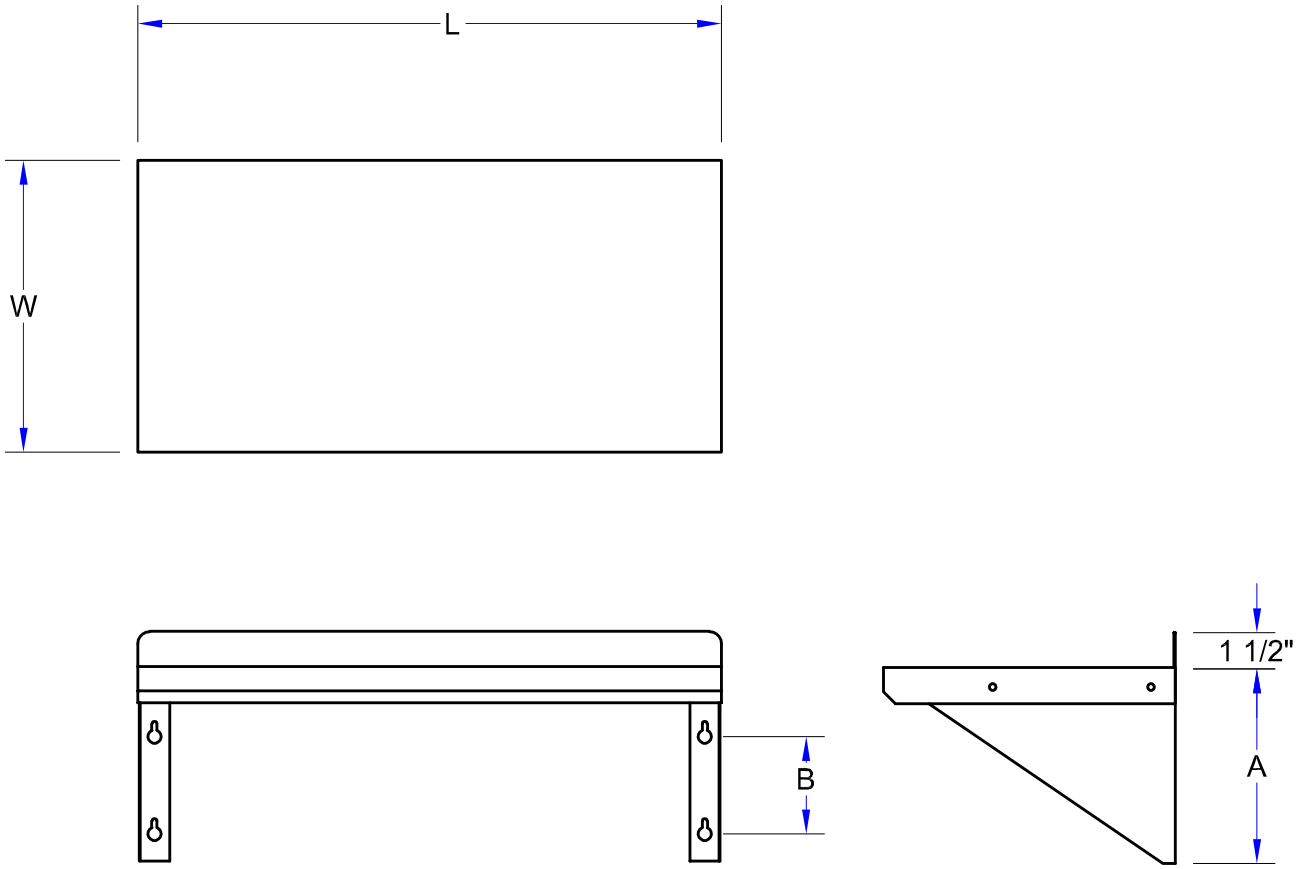
"EWS8" WALL SHELVES - STAINLESS STEEL

LENGTH	12" WIDE	A	B	WT (LBS)	16" WIDTH	A	B	WT (LBS)
24"	**EWS8-1224**	8"	4"	8	**EWS8-1624**	11-1/2"	7-1/2"	10
36"	**EWS8-1236**	8"	4"	12	**EWS8-1636**	11-1/2"	7-1/2"	14
48"	**EWS8-1248**	8"	4"	16	**EWS8-1648**	11-1/2"	7-1/2"	18
60"	**EWS8-1260**	8"	4"	21	**EWS8-1660**	11-1/2"	7-1/2"	24
72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
84"	**EWS8-1284** *	8"	4"	29	**EWS8-1684** *	11-1/2"	7-1/2"	35
96"	**EWS8-1296** *	8"	4"	33	**EWS8-1696** *	11-1/2"	7-1/2"	38

***NOTE: UNITS 6 FT. AND LARGER ARE FURNISHED WITH 3 SUPPORT BRACKETS**

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DETAILED SPECIFICATIONS



"EWS8" WALL SHELVES - STAINLESS STEEL

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SPEC SHEET

"EWS8" WALL SHELVES

Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
- 1-1/2" Turned Up Backsplash
- 12" Or 16" Depth
- Shipped Knocked-Down, Easy-To-Assemble
- All Models Are NSF Certified

SPECIFICATIONS:

- Stainless Steel Shelves Are TIG Welded
- Exposed Welds Are Polished To Match Adjacent Surface
- Shelf: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish
- Brackets: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish

CERTIFICATIONS:



EWS8-1636

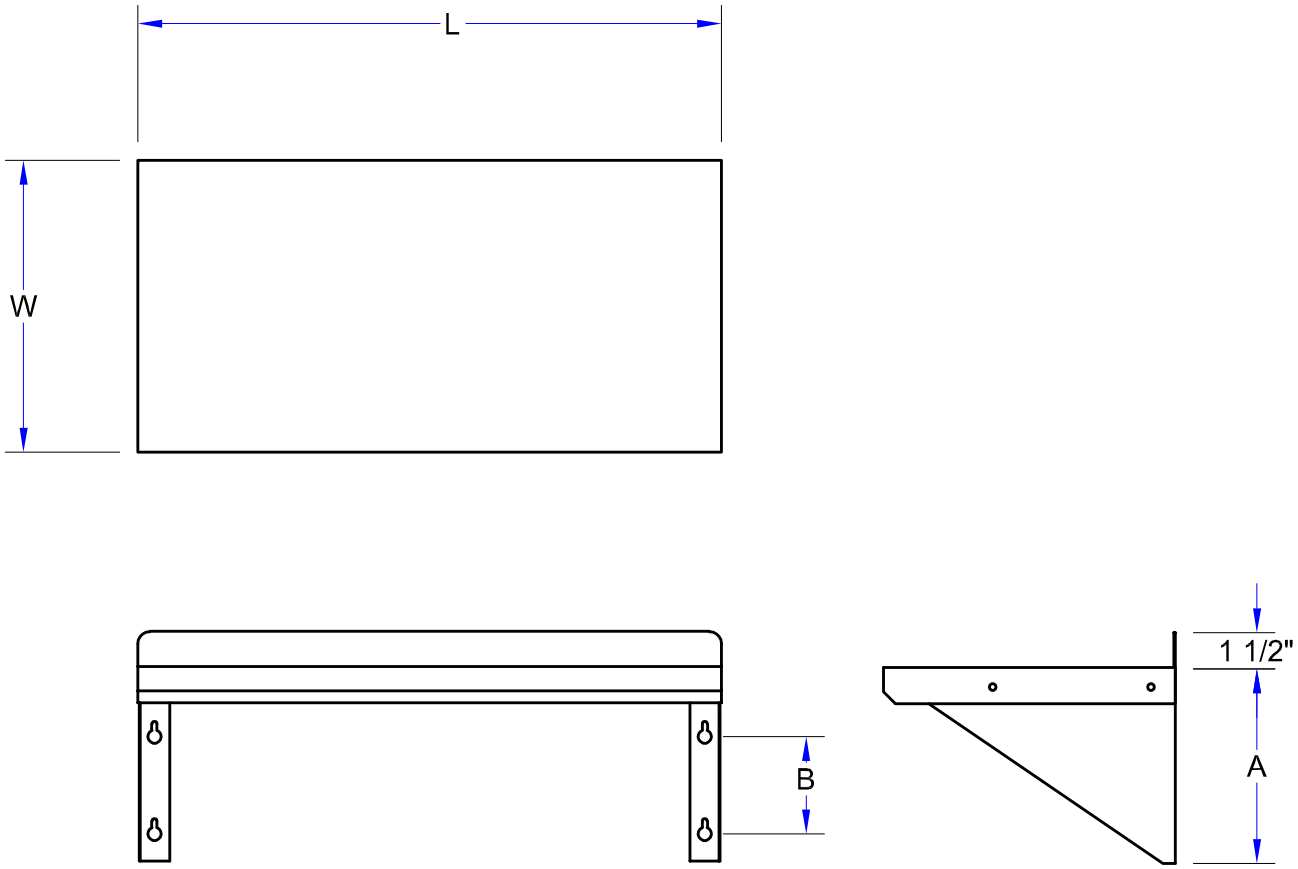
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DETAILED SPECIFICATIONS



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SPEC SHEET

"EWS8" WALL SHELVES

Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
- 1-1/2" Turned Up Backsplash
- 12" Or 16" Depth
- Shipped Knocked-Down, Easy-To-Assemble
- All Models Are NSF Certified

SPECIFICATIONS:

- Stainless Steel Shelves Are TIG Welded
- Exposed Welds Are Polished To Match Adjacent Surface
- Shelf: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish
- Brackets: 18GA Type 430 Stainless Steel With #4 Polish, Satin Finish

CERTIFICATIONS:



EWS8-1636

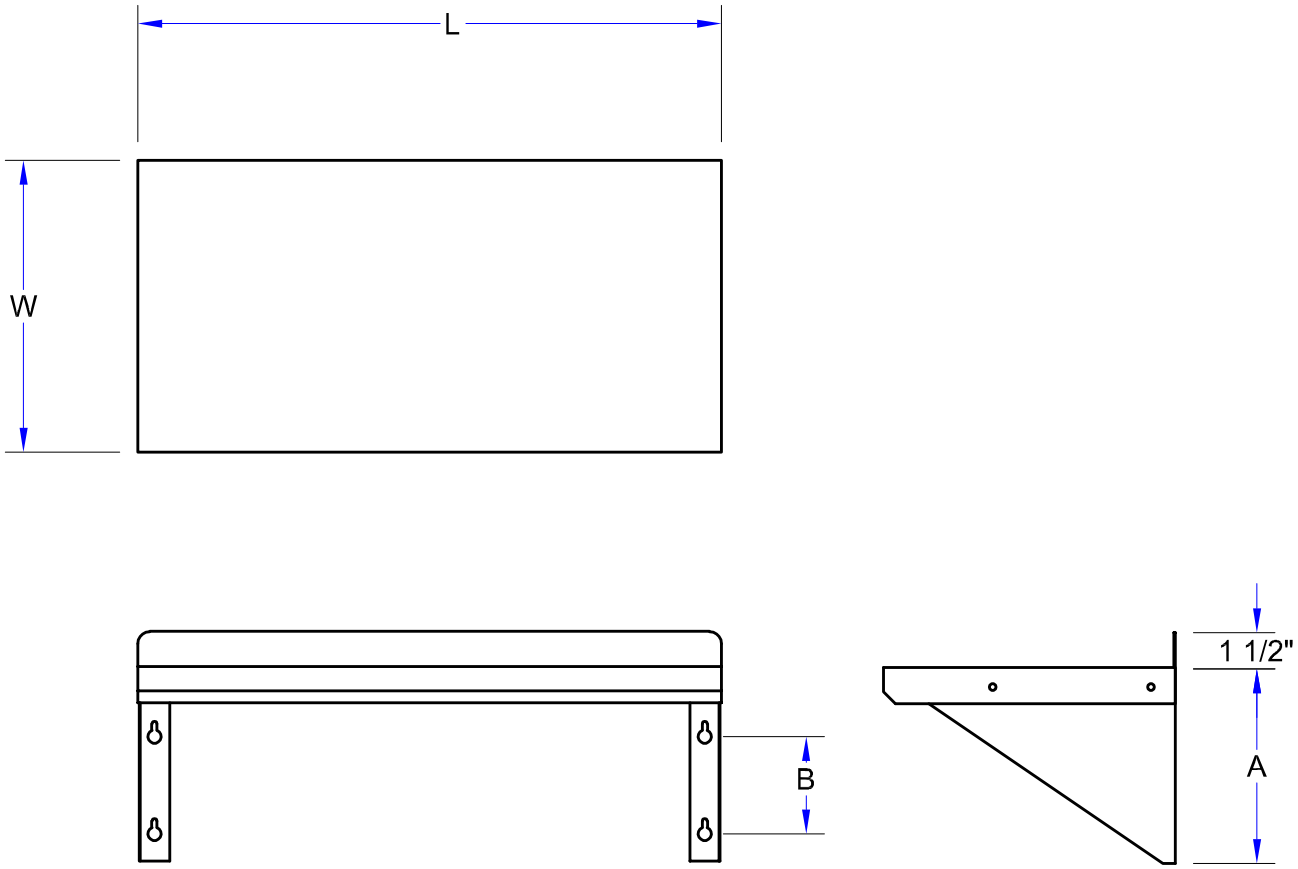
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SPEC SHEET

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Type 430 Stainless Steel w/1.5" Rear Riser

FEATURES:

- 18GA, Type 430 Stainless Steel With #4 Polish, Satin Finish
- Finished With A Safety Stallion Front Edge
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CERTIFICATIONS:



EWS8-1636

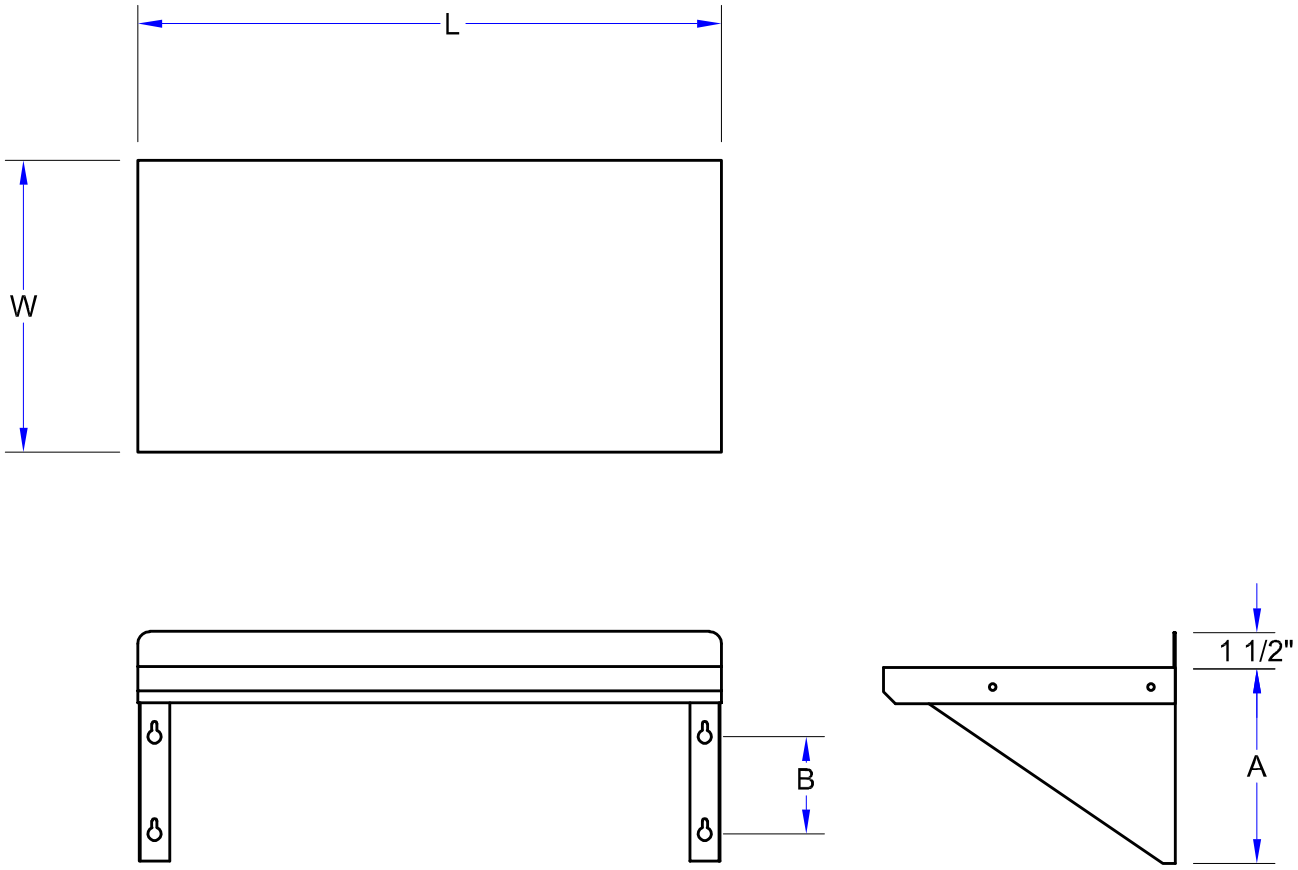
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72"	**EWS8-1272** *	8"	4"	25	**EWS8-1672** *	11-1/2"	7-1/2"	30
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DETAILED SPECIFICATIONS



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Outperform every day.™

Project:

Item Number:

Quantity:

CAYENNE® MODEL 1001 WARMERS



MODELS

Item No	Model No	Description
71001	1001	Full-Size Warmer

DESCRIPTION

Cayenne® Model 1001 Warmers are designed to attractively display and maintain the serving temperature of your prepared foods with less energy than a traditional warmer.

PERFORMANCE CRITERIA

Cayenne® Model 1001 Warmers are designed to hold heated prepared foods at temperatures above the HACCP "danger zone" of 140° F (60° C). The performance standard is measured using the NSF mixture preheated to 165° F (73.9° C). The unit will hold the temperature of this product above 150° F (65.6° C). The temperature will be maintained best when the food product is held using pans with covers, the proper water level is maintained in the well, and the food product is stirred regularly.

FEATURES

- Features Vollrath's Direct Contact Heating System in which the heating element is in direct contact with the water for the most efficient heat transfer possible
- Cast-in non-stick aluminum dome heating element uses up to 25% less energy and reduces scale build-up for easy cleaning and longer operating life
- Thermoset fiber-reinforced self-insulating resin well provides maximum energy efficiency, prevents scale build-up and is easy to clean
- Increased water capacity reduces labor costs and improves food quality by maintaining maximum moist heat
- Recessed controls reduce accidental changes in temperature settings
- Low-water indicator light eliminates guesswork
- Capillary tube thermostat control supplies constant temperature and power only when needed for maximum power efficiency
- Wide dripless lip catches and drains moisture back into the well and creates more uniform fit with food pans and insets
- Stainless steel exterior meets UL surface temperature standards for operator and customer safety and concentrates heat inside the well, not to the outside surface and rim
- Meets NSF4 Performance Standards for hot food holding equipment
- Non-skid feet help keep unit from sliding on countertop
- Bottom exit 6 ft. (183 cm) power cord adapts to receptacle location for safe installation and allows for 360° control placement

WARRANTY

All models shown come with Vollrath's standard warranty against defects in materials and workmanship. For full warranty details, please refer to www.Vollrath.com.

AGENCY LISTINGS

c UL us LISTED NSF

Approvals	Date

Due to continued product improvement, please consult www.vollrath.com for current product specifications.

Outperform every day.™

The Vollrath Company, L.L.C.
1236 North 18th Street
Sheboygan, WI 53081-3201 U.S.A.
Main Tel: 800.624.2051 or 920.457.4851
Main Fax: 800.752.5620 or 920.459.6573
Customer Service: 800.628.0830
Canada Customer Service: 800.695.8560

Technical Services
techservicereps@vollrathco.com
Induction Products: 800.825.6036
Countertop Warming Products: 800.354.1970
All Other Products: 800.628.0832

CAYENNE® MODEL 1001 WARMERS

SPECIFICATIONS

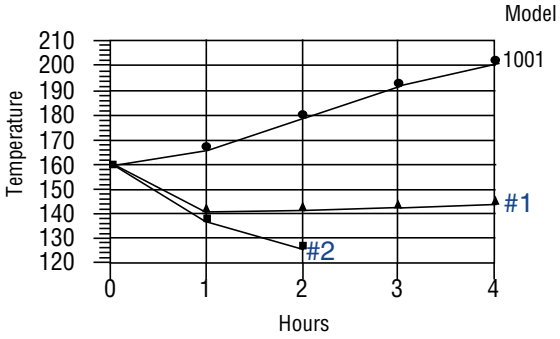
Item No.	Dimensions IN (CM)	Well Depth IN (CM)	Voltage	Watts	Amps	Plug
71001	13¾ x 21¾ x 9 (33 x 55 x 23)	6 (15.2)	120	700	5.8	5-15P

Receptacle

120V



NEMA 5-15R



Results of Independent Testing:

Units were filled with water per care/use instructions. Units were preheated to operating temperature. 4" (100 cm) food pan containing NSF test mixture at 160° F (71.1° C) was inserted. All tests were made with the cover off. Temperature was monitored continuously for four hours.

- Model 1001 with 700 watt dome element maintained temperature of the food product above the temperature 160° F (71.1° C) for the duration of the test.
- Competitive all-stainless unit (#1) with 1200W tubular element under the well. Temperature dropped below 140° F (60° C) in eight minutes. Continued testing saw temperature rise above 140° F (60° C).
- Competitive all-stainless unit (#2) with thermostatic control and 1500W tubular element under the well. Temperature dropped below 140° F (60° C) safety zone within the first hour and did not recover. Test was aborted after 2 hours.

VOLLRATH®
Outperform every day.™
www.vollrath.com

The Vollrath Company, L.L.C.
1236 North 18th Street
Sheboygan, WI 53081-3201 U.S.A.
Main Tel: 800.624.2051 or 920.457.4851
Main Fax: 800.752.5620 or 920.459.6573
Customer Service: 800.628.0830
Canada Customer Service: 800.695.8560

Technical Services
techservicereps@vollrathco.com
Induction Products: 800.825.6036
Countertop Warming Products: 800.354.1970
All Other Products: 800.628.0832

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Printed in USA

Item # _____ C.S.I. Section 11420

HEATED HOLDING

VP18
18 PAN NON-INSULATED HEATED HOLDING & PROOFING CABINET



Model VP18

SPECIFICATIONS

Eighteen level heated holding and proofing cabinet, Vulcan Model No. VP18. Heavy duty 20 gauge polished stainless steel cabinet. Four 5" casters, two swivel with brakes, two rigid. Glass door with heavy duty hinges, door latch mechanism and gaskets. Adjustable interior pan supports adjust on 3" centers and are removable for easy cleaning. Accommodates up to eighteen 18" x 26" sheet pans and thirty six 12" x 20" x 2¾" steam table pans. Includes ½ gallon water pan for proofing, drip trough and removable condensation pan on the bottom of cabinet. Top mounted, control panel includes fan on/off switch, dial thermostat adjustable from ambient to 190°F, cabinet temperature thermometer, and switch to change from proofing to holding. 2,000 total watt heating elements with stainless steel cover, 16.7 total amp draw. One year limited parts and labor warranty. After the first year, 10-year parts warranty on the heating elements. Requires 120 volt single phase power supply. Furnished with top mounted power cord with strain relief and NEMA 5-20 plug.

Exterior Dimensions:

25¼" W x 30¾" D x 71" H

UL Listed. Classified by UL to NSF Std. #4.

STANDARD FEATURES

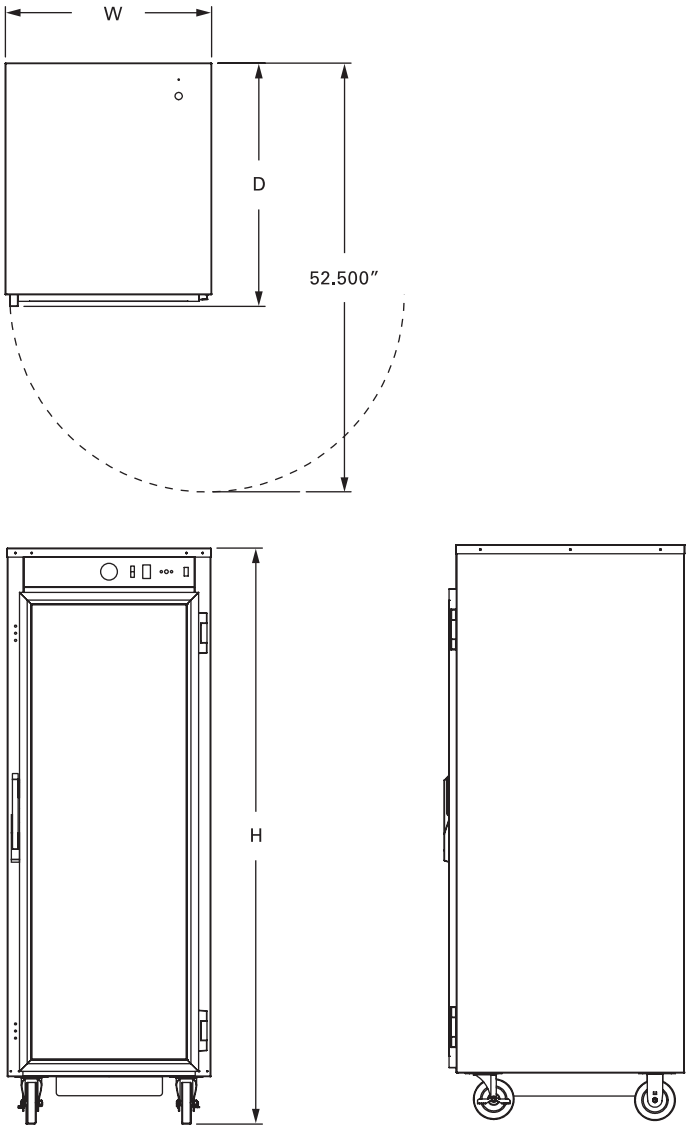
- Eighteen level heated holding and proofing cabinet accepts eighteen 18" x 26" pans or thirty-six 12" x 20" pans.
- Heavy duty 20 gauge polished stainless steel cabinet.
- Set of 5" casters, two swivel with brakes and two rigid.
- Full size glass door with field reversible heavy duty hinges, door latch mechanism, and gaskets provide visibility of the contents in the cabinet.
- Adjustable interior pan supports adjust on 3" centers and are removable for easy cleaning.
- Top mounted, control panel includes fan on/off switch, dial thermostat adjustable from ambient to 190°F, cabinet temperature thermometer, and switch to change from proofing to holding.
- Top mounted control panel is easy to use and out of the way of brooms, mops, and feet. Control panel on top eliminates removing control panel for cleaning.
- Fan and air tunnel provide even heat distribution.
- 2,000 total watt heating elements with stainless steel cover, 16.7 amps total draw.
- Requires 120 volt, single phase power supply.
- Furnished with top mounted power cord with strain relief and NEMA 5-20 plug (except for Canada which comes with a 5-30 plug).
- Furnished with ten pairs of tray slides.
- Includes ½ gallon water pan for proofing, drip trough and removable condensation pan on the bottom of cabinet.
- One year limited parts and labor warranty. After the first year, 10-year parts warranty on the heating elements.

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

HEATED HOLDING

VP18
18 PAN NON-INSULATED HEATED HOLDING & PROOFING CABINET



CAPACITY		DIMENSIONS	ELECTRICAL			SHIPPING WEIGHTS
18" X 26" PANS	12" X 20" PANS	EXTERIOR	VOLTS	WATTS	AMPS	LBS / KG
18	36	25¼" W x 30¾" D x 71" H	120	2,000	16.7	236 lbs. / 107 kg.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

Delfield®

4448NP

Front-Breathing Self-Contained Flat Top Refrigerated Bases

Models

- 4448NP Single Section with Doors
- D4448NP Single Section with Drawers
- ST4448NP Single Section with Doors with Backsplash
- STD4448NP Single Section with Drawers with Backsplash



4448NP

Standard Features

- All 4400 Series units are 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet, or an existing lineup.
- Durable, rugged stainless-steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable – it won't dent, chip or corrode and is backed by a limited lifetime warranty.
- "D" prefix models feature Delfield's new drawer system. Drawers are backed by a lifetime warranty on the track assembly.
- Bent in full length handle on doors and drawers.
- Standard on 5" casters for easy cleaning and installation
- One wire shelf standard, installed per door section.
- ACT solid state electronic control
- Environmentally friendly R290 refrigerant
- High density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low.
- 10' cord and plug supplied
- Three-year parts and labor warranty and a seven-year compressor parts warranty

Options & Accessories

- 18" wide single tier over shelf
- Stainless steel finish on back
- Cutting Boards
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height available
- Door lock
- Exterior thermometer (some models excluded)

Specifications

Exterior top is one-piece, 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. ST and STD models have standard backsplash, full width and 4" (10cm) tall.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel. Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of cabinet. Evaporator coil is located on the interior rear wall of cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior temperature of 33°F to 41°F (0°C to 4°C).

ACT control: ACT electronic, solid-state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connection is 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15 plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking brakes. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-guage stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable wire shelf.

Drawers have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Top drawer holds one full size 12" x 20", 4"-6" (30.5cm x 50.8cm x 10.2cm) deep pan, and three 1/6 size pans. Bottom drawer holds one full size 12" x 20" and three 1/6 size, 4" deep pans. Pans are supplied by others.

R290

4448NP Flat Top Refrigerated Bases

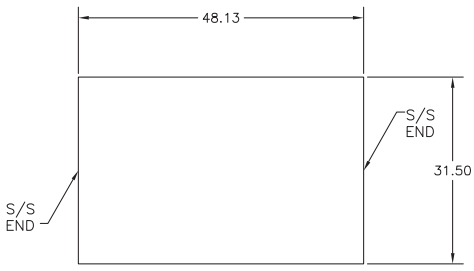
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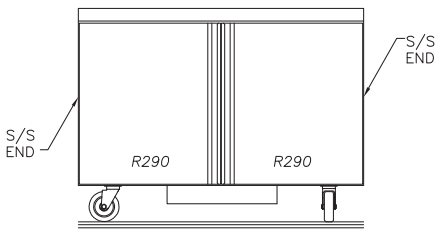
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4448NP_Spec
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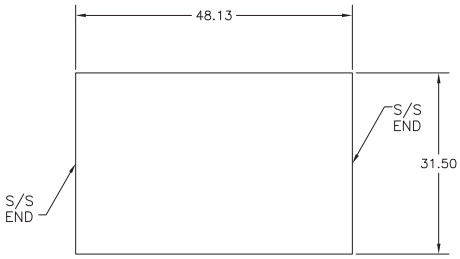
Delfield®

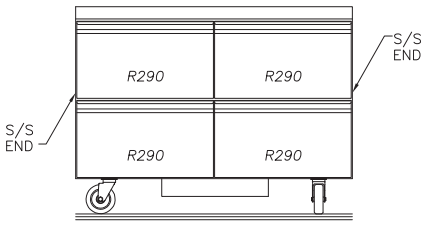
4448NP Flat Top Refrigerated Bases



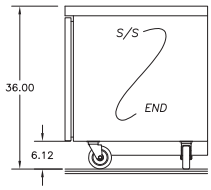


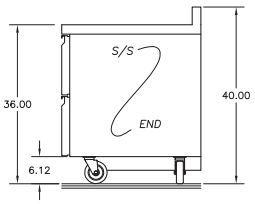
MODEL: 4448NP

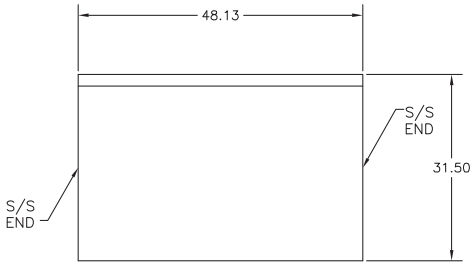


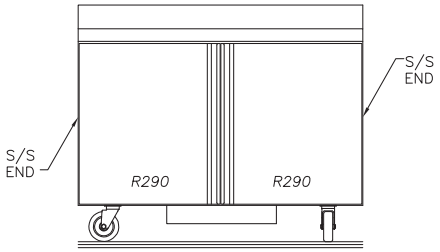


MODEL: D4448NP

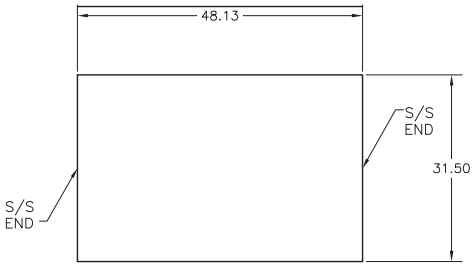


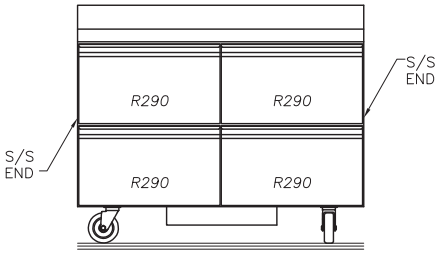






MODEL: ST4448NP





MODEL: STD4448NP

Specifications

Model	# of Shelves	Shelf Area	Storage Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
D4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg
ST4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
STD4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg

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4448NP_Spec
07/23

STOELTING
A VOLLRATH® DIVISION

Project:

Item Number:

Quantity:

E122/F122 COUNTERTOP SHAKE FREEZERS OR FROZEN BEVERAGE DISPENSERS



E122



F122

NSF C UL US LISTED

DESCRIPTION

Compact, space-saver machines offer the convenience to serve frozen beverages, shakes, smoothies or frozen cocktails. IntelliTec2™ control communicates with the operator through a multi-line graphics LCD using full text instructions.

INTELLITEC2™ CONTROL FEATURES

- Programmable and configurable through multi-line graphics display.
- Upload firmware and download statistics through a USB connection.
- Performance and error logs provide data to maximize profitability.
- Senses product consistency or temperature to customize for a wide variety of mixes.
- Standby and sleep modes conserve energy and automatically defrost product, maintaining small ice crystals and delivering a superior mouthfeel.
- Tamper-proof controls for self-serve applications.

STOELTING WHITE GLOVE SERVICE NETWORK

Every machine includes Stoelting's White Glove Service. One call does it all – customer service, technical service, parts or warranty information, installation, startup, sales, on-site service dispatch and much more. Available 24 hours a day, seven days a week year-round.

Continuous research leads to ongoing product improvements; therefore, these specifications are subject to change without notice and should not be used as installation specifications.

ITEMS

❑	**E122-38I2**	Air cooled, single phase
❑	**E122-38I2AF**	Air cooled, single phase, autofill ready
❑	**E122-38I2P**	Air cooled, single phase, with plenum
❑	**F122-38I2**	Air cooled, single phase
❑	**F122-38I2-AF**	Air cooled, single phase, autofill ready
❑	**F122-38I2P**	Air cooled, single phase, with plenum
❑	**F122-18I2**	Water cooled, single phase
❑	**F122-18I2-AF**	Water cooled, single phase, autofill ready

ACCESSORIES & OPTIONS

❑	**2183807**	E112 Autofill Ready Kit - Includes hopper cover, tubing, and solenoid. Requires autofill system
❑	**2187101**	F112 Autofill Ready Kit - Includes hopper cover, tubing, and solenoid. Requires autofill system
❑	**4177349**	Fill-O-Matic II Autofill System - Electric Pumps up to 60 gallons per hour
❑	**4177370**	Fill-O-Matic III Autofill System - Gas Pumps up to 45 gallons per hour
❑	**4177350**	FS2 - Floor Stand 22" x 24" x 31" E122 Set-on-top stand
❑	**4183513**	FSS2 - Floor Stand 22" x 24" x 26" E122 Set-on-top stand
❑	**2203214**	FS3 - Floor Stand 31-3/4" x 26-1/4" x 22-1/2" E122 Set-on-top stand, F122 Mount-to-stand
❑	**2202408**	FS4 - Floor Stand 24-1/4" x 22-1/4" x 18-3/4" E122 Set-on-top stand
❑	**2208358**	FS5 - Floor Stand 25-7/8" x 33-3/8" x 22-1/2" E122 Set-on-top stand, F122 Mount-to-stand

FEATURES

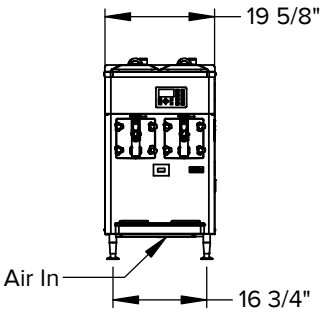
- NSF approved food grade plastic blades provide quiet operation and superior durability.
- Simplified design for quick assembly after cleaning.
- On demand defrost prevents ice buildup and ensures a smooth frozen treat with consistent quality.
- Clear door displays circulating product for merchandising appeal.
- Highly efficient auger design gently folds the entire contents of the freezing cylinder, delivering a thick, smooth, and creamy product.
- Efficient freezing cylinder and auger design deliver a consistent uniform creamy product and a quick recovery time.
- Compact counter-top design saves valuable counter space.
- Single switch for simple operation and cleaning.

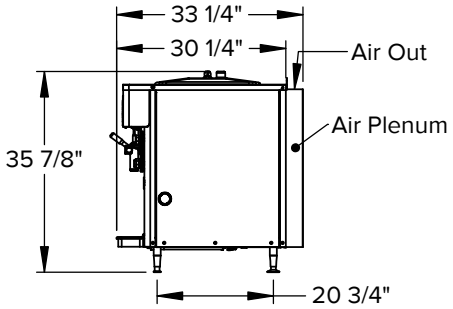
Approvals	Date

E122/F122 COUNTERTOP SHAKE FREEZERS OR FROZEN BEVERAGE DISPENSERS

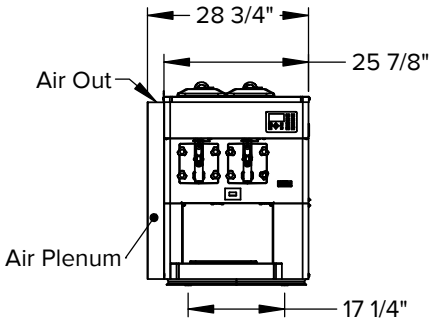
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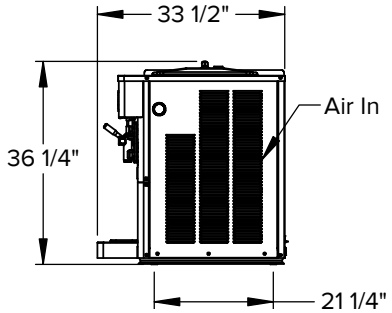
Model E122





Model F122





GENERAL SPECIFICATIONS

Model	Freezing Cylinder				Hopper Capacity gallon (L)	Drive Motor (hp)	Weight lb (kg)	Crated Weight lb (kg)
	Capacity gallon (L)	Compressor						
		Btu/hr	Refrigerant	Charge (oz)				
E122	Two 1.25 (4.73)	6,400	R-448A	32	Two 3 (11.36)	1/3	275 (124.7)	364 (165.1)
F122	Two 2 (7.57)	12,000	R-448A	A/C: 42 W/C: 32	Two 3 (11.36)	1/2	390 (176.9)	458 (207.7)

- Indoor use only.
- Maximum ambient temperature: 100°F (37.8°C).
- Requires a dedicated electrical circuit.
- Air cooled units require: 6" (15.24 cm) air space on both sides
- Water cooled units require: 3/8" N.P.T. water and drain fittings. Maximum water pressure of 130 psi. Minimum water flow rate of 3 GPM per barrel. Ideal EWT of 50°-70°F.
- Details on CAD Revit Symbols Libraries are available on stoelting.kclcad.com

ITEM NUMBER SPECIFICATIONS

Model Number	Cooling	Phase	Volts	Hz	Running Amps	Cord with Plug (Included)	Autofill Ready	Plenum Kit
E122-38I2	Air	1	208-240	60	10.6	NEMA 6-15P	—	—
E122-38I2AF							✔	—
E122-38I2P							—	✔
F122-38I2	Air	1	208-240	60	10.1	NEMA 6-20P	—	—
F122-38I2-AF							✔	—
F122-38I2P							—	✔
F122-18I2	Water	1	208-240	60	9.1	NEMA 6-20P	—	—
F122-18I2-AF							✔	—

STOELTING
A VOLLRATH® DIVISION

Service Information
800-319-9549 (U.S. Toll Free)
920-894-2293 (Outside the U.S.)
www.stoeltingfoodservice.com
www.vollrath.com

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Delfield®

4448NP

Front-Breathing Self-Contained Flat Top Refrigerated Bases

Models

- 4448NP Single Section with Doors
- D4448NP Single Section with Drawers
- ST4448NP Single Section with Doors with Backsplash
- STD4448NP Single Section with Drawers with Backsplash



4448NP

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- One wire shelf standard, installed per door section.
- ACT solid state electronic control
- Environmentally friendly R290 refrigerant
- High density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low.
- 10' cord and plug supplied
- Three-year parts and labor warranty and a seven-year compressor parts warranty

Options & Accessories

- 18" wide single tier over shelf
- Stainless steel finish on back
- Cutting Boards
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height available
- Door lock
- Exterior thermometer (some models excluded)

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Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of cabinet. Evaporator coil is located on the interior rear wall of cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior temperature of 33°F to 41°F (0°C to 4°C).

ACT control: ACT electronic, solid-state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connection is 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15 plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking brakes. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-guage stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable wire shelf.

Drawers have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Top drawer holds one full size 12" x 20", 4"-6" (30.5cm x 50.8cm x 10.2cm) deep pan, and three 1/9 size pans. Bottom drawer holds one full size 12" x 20" and three 1/9 size, 4" deep pans. Pans are supplied by others.

ENERGY STAR
*Drawer models excluded

R290

4448NP Flat Top Refrigerated Bases

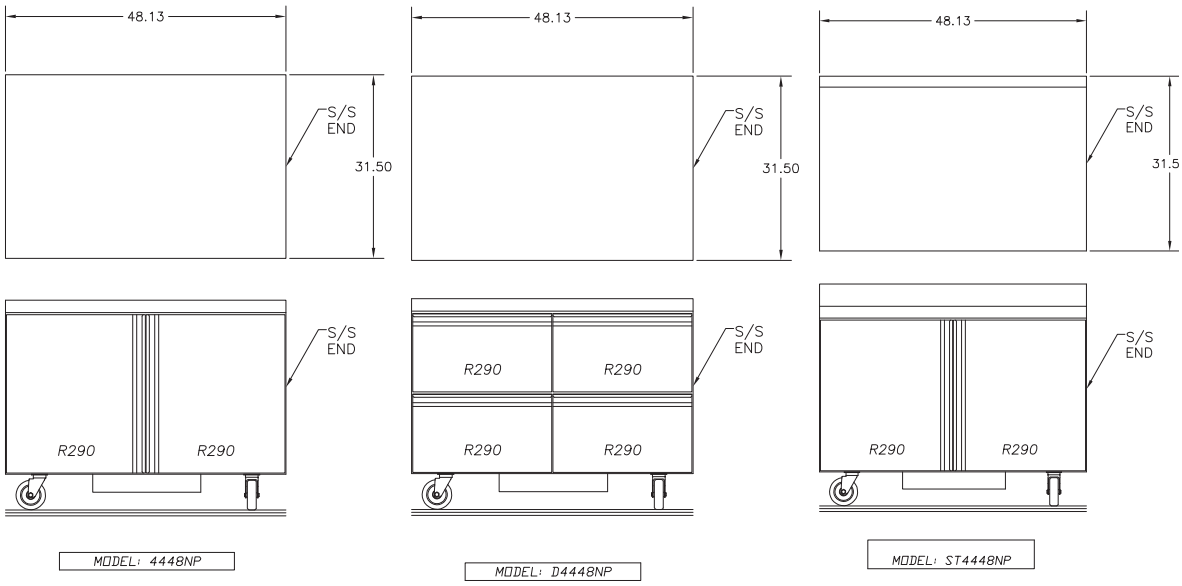
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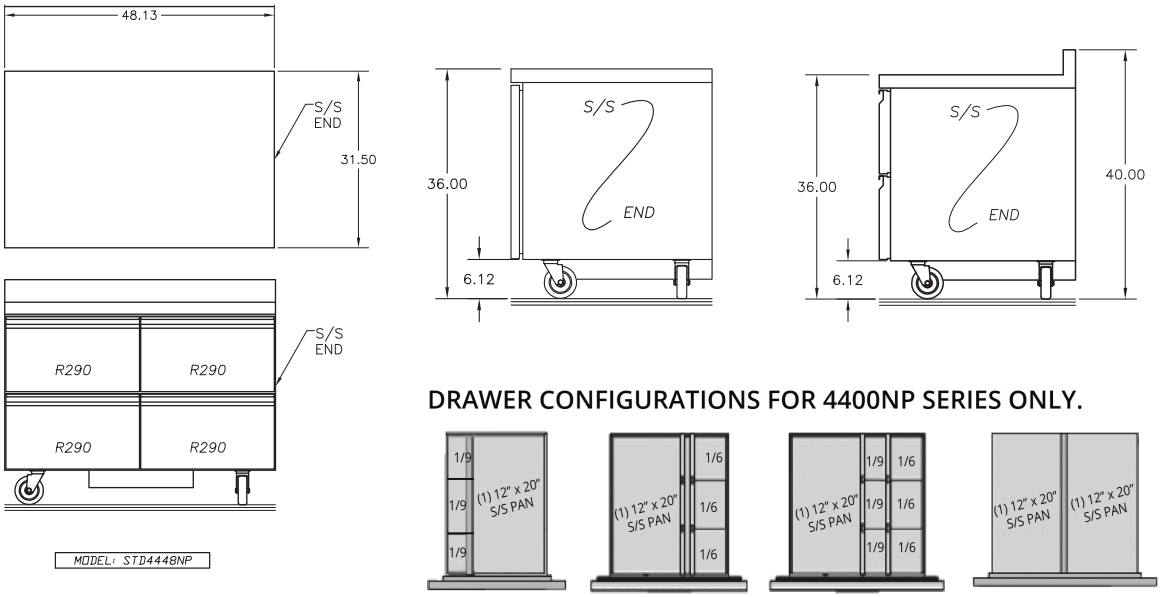
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4448ANP_Spec
02/24

Delfield®

4448NP Flat Top Refrigerated Bases





DRAWER CONFIGURATIONS FOR 4400NP SERIES ONLY.

Specifications

Model	# of Shelves	Shelf Area	Storage Volume	h.p.	V/Hz/Ph	Amps	Energy (kWh/day)	nema plug	Ship Weight
4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	1.01	5-15P	316lbs/143kg
D4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	N/A	5-15P	398lbs/181kg
ST4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	1.01	5-15P	316lbs/143kg
STD4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	N/A	5-15P	398lbs/181kg

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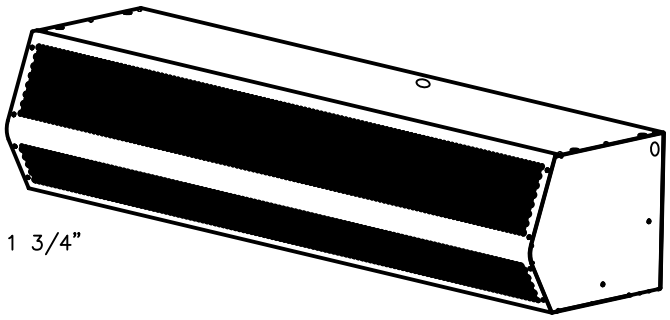
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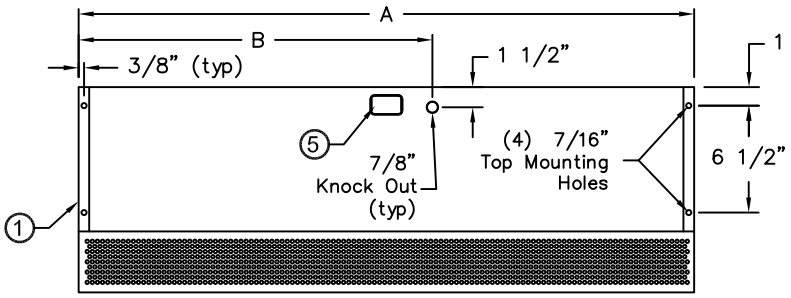
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Web Site: www.marsair.com • E-mail:info@marsair.com

PROJECT			OPTIONS/ITEMS
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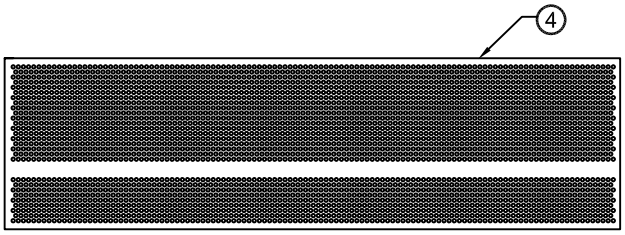
Unheated Drawing

STD2
(Standard 2) Series

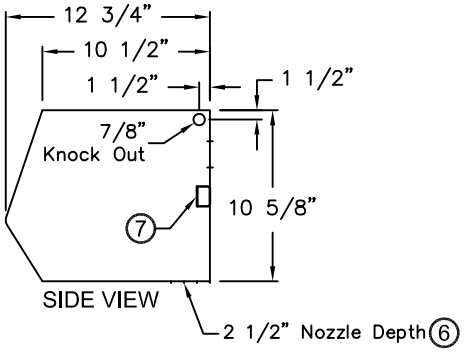




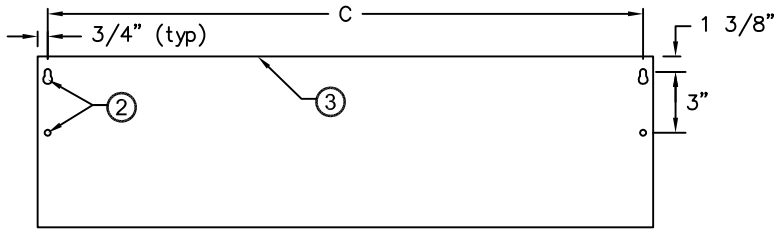
TOP VIEW



FRONT VIEW



SIDE VIEW



REAR VIEW

amca CERTIFIED RATINGS — AIR PERFORMANCE — AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

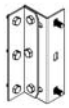
Note: Models STD260-2, STD264-2, STD278-2, STD296-3 & STD2108-2 are not AMCA Certified

ETL LISTED c US — Intertek

8 Recommended Accessories


Control Panels


Door Limit Switches


Brackets

*- Use corresponding letters in "Electrical Data" columns to complete the model numbers.

MODEL NUMBER	OVERALL LENGTH A (in)	KNOCKOUT LOCATION B (in)	REAR MOUNTING CENTER C (in)
STD236-1U*-OB	36	25 1/2	34 1/2
STD242-1U*-OB	42	28 1/2	40 1/2
STD248-1U*-OB	48	31 1/2	46 1/2
STD260-2U*-OB	60	37 1/2	58 1/2
STD272-2U*-OB	72	40	70 1/2
STD284-2U*-OB	84	46	82 1/2
STD296-2U*-OB	96	52	94 1/2
STD2108-3U*-OB	108	58	106 1/2
STD2120-3U*-OB	120	64	118 1/2
STD2144-3U*-OB	144	76	142 1/2

Notes:

1. This product is designed to meet the National Electric Code (NEC), ETL Listed (UL 507 and CSA 22.2) and AMCA 211 Certified.
2. (2) 1/2" key hole slots and (2) 7/16" mounting holes provided for wall mounting and (4) 7/16" mounting holes for overhead mounting provided, (2) on each end.
3. All units have a self contained one piece cabinet, fire retardant and corrosion proof paint lock metal double protected with baked on Obsidian Black color, rust preventative electrostatic polyurethane powder coating.
4. Cabinet has sufficient strength for fastening to wall on both ends without intermediate support.
5. Internal J-Box(es) for electrical wiring: one motor-(1) 2"x 4"; two motors-(1) 4"x 4"; three motors-(2) 4"x 4".
6. Unit is to be installed such that air flow is unobstructed. Air discharge nozzle containing adjustable air directional vanes with 40° sweep front to back.
7. Circuit protection as per NEC by others.
8. Optional motor control panel, door limit switch and mounting brackets are field installed and/or wired by others. The door limit switch is to be mounted such that the air curtain turns on as door begins to open. To prevent unit damage, the mounting brackets must be installed such that the bottom of the air curtain is not below the door header.

STD2 (Standard 2) Series

Unheated

Model Lengths 36" – 144"

atmosphere is everything

14716 S. BROADWAY, GARDENA, CA 90248 ● Ph: (310)532-1555 Fax: (310)-532-3030 ● www.marsair.com
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Unheated Data Sheet

Applications: Environmental Separation (up to 10') and Insect Control (up to 8')

STD2 (Standard) Series 2	Mechanical Data						AMCA Certified Lab Data				
Model Number	Nozzle Length (in)	Length (in)	Depth (in)	Height (in)	Motor (hp)	Weight (lbs)	Max Core Velocity at Nozzle (fpm)	Avg Velocity (fpm)	Volume (cfm)	Uniformity (%)	Power Rating (watts)
STD236-1U*-OB	36	36	13	11	1/2	60	5960	2206	1379	84	500
STD242-1U*-OB	42	42	13	11	1/2	65	4865	1945	1418	87	510
STD248-1U*-OB	48	48	13	11	1/2	70	4247	1730	1442	85	550
STD260-2U*-OB	60	60	13	11	Two 1/2	90	6737	2592	2700	93	940
STD272-2U*-OB	72	72	13	11	Two 1/2	120	5960	2206	2758	84	1000
STD284-2U*-OB	84	84	13	11	Two 1/2	125	4865	1945	2836	87	1020
STD296-2U*-OB	96	96	13	11	Two 1/2	135	4247	1730	2884	85	1100
STD2108-3U*-OB	108	108	13	11	Three 1/2	175	5960	2206	4137	84	1500
STD2120-3U*-OB	120	120	13	11	Three 1/2	185	4660	2084	4341	92	1570
STD2144-3U*-OB	144	144	13	11	Three 1/2	200	4247	1730	4326	85	1650

* - Use corresponding letters in "Electrical Data" columns to complete the model numbers.

Note: Data above for 1725 RPM at 60 Hz, 50 Hz is 1425 RPM with a 17% reduction in the performance data.

1. The AMCA Certified Ratings Seal applies to airflow rate, average outlet velocity, outlet velocity uniformity, velocity projection and power rating at free delivery only.
2. Rated data shown are only for base (unheated) units, as shown.

Features:

- 1/2 HP Continuous Duty TEAO Motors
- Sleek self-contained one piece heavy gauge corrosion proof paint lock metal design
- ETL Certified to conform to UL 507 (US) and CSA 22.2 (Canada) Standards
- AMCA Certified to AMCA 211 (see table above for models available)
- (4) 7/16" top and wall mounting holes provided, (2) on each end
- Cabinet has sufficient strength for fastening to wall on both ends without intermediate support
- Adjustable air directional vanes with 40° sweep front to back
- Standard color is Obsidian Black
- Rust preventative electrostatic polyurethane powder coating
- 5 year parts warranty
- Freight Included (FOB Continental USA)
- Proudly Made in the USA

Electrical Data (FLA)	Unit Voltage (Voltage Code)						
	Single Phase			Three Phase			
	115v/1Ø (A)	208/230v/1Ø (D)	277v/1Ø (L)	208/230v/3Ø (G)	460v/3Ø (H)	575v/3Ø (I)	380v/3Ø/50Hz (W)
STD236-1U*-OB	5.1	2.5	2.7	1.8/1.6	0.8	0.7	1.8
STD242-1U*-OB	5.1	2.5	2.7	1.8/1.6	0.8	0.7	1.8
STD248-1U*-OB	5.1	2.5	2.7	1.8/1.6	0.8	0.7	1.8
STD260-2U*-OB	10.2	5.0	5.4	3.6/3.2	1.6	1.4	3.6
STD272-2U*-OB	10.2	5.0	5.4	3.6/3.2	1.6	1.4	3.6
STD284-2U*-OB	10.2	5.0	5.4	3.6/3.2	1.6	1.4	3.6
STD296-2U*-OB	10.2	5.0	5.4	3.6/3.2	1.6	1.4	3.6
STD2108-3U*-OB	15.3	7.5	8.1	5.4/4.8	2.4	2.1	5.4
STD2120-3U*-OB	15.3	7.5	8.1	5.4/4.8	2.4	2.1	5.4
STD2144-3U*-OB	15.3	7.5	8.1	5.4/4.8	2.4	2.1	5.4

* - Use corresponding letters in "Electrical Data" columns to complete the model numbers.

Note: For Ampacity Multiply FLA X 1.25

Options and Accessories: (see Accessories Brochure)

- Motor Control Panels
- Wall and Overhead Bracket
- Multi-speed motors and controls
- Washdown units and accessories (NEMA 4 & 4X)
- Explosion Resistant units and accessories (Class I, Div. I, Group D)
- Custom colors and finishes (304SS, 316SS)

Sound Levels: (measured at 10' in an open field)

1 Motor Unit = 66 dBA, 2 Motor Unit = 68 dBA, 3 Motor Unit = 71 dBA & 4 Motor Unit = 73 dBA

EXAMPLE

STD2 72 - 2 U H - OB

- STD2: Series: Standard 2
- 72: LENGTH OF UNIT
- 2: # OF MOTORS
- U: U = UNHEATED
- H: VOLTAGE CODE
- OB: COLOR

Projection Velocity		
Model	Distance from nozzle (in)	Avg. Core Velocity (FPM)
STD236-1U*-OB	36"	1522
	48"	1312
	60"	1158

MARS Air Systems, LLC certifies that the Air Curtains shown on this data sheet are licensed to bear the AMCA seal. The rating shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.

Note: Models STD260-2, STD264-2, STD278-2, STD296-3 & STD2108-2 are not AMCA Certified.

Intertek

NOTE: MARS AIR SYSTEMS, LLC reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment.

STD2U-B; August 09, 2016

Delfield

204 Series

Water And Ice Station

Project _____

Item _____

Quantity _____

CSI Section 11400

Approved _____

Date _____

204 Series: Water And Ice Station

Models

- 204 Water and ice station with glass filler
- 204P Water and ice station with pitcher filler



204

Standard Features

- Top is 18-gauge stainless steel with raised die stamped opening
- Chrome plated wire strainer
- Glass filler is 9.5" high
- Pitcher filler is 13.5" high
- One-piece 20-gauge stainless steel lift-off cover with handle
- Liner of ice bin is high-impact ABS plastic with coved corners
- 1" diameter drain plumbed out the bottom
- High density environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane foam throughout unit
- Exterior tank is made of galvanized steel

Specifications

Top is 18-gauge stainless steel, has 1.37" (3 cm) overhang all around. Glass filler is 9.5" (24 cm) high, over die-stamped drain opening fitted with chrome-plated wire strainer. Pitcher filler is 13.5" (34 cm) high, over die-stamped drain opening fitted with chrome-plated wire strainer. Ice bin opening is die-stamped with .19" (5 mm) raised edges, measures 15.12" x 10.5" (38 cm x 27 cm), has one-piece 20-gauge stainless steel lift-off cover.

Liner of ice bin is high-impact ABS plastic, has rounded corners and is pitched to 1" (25 mm) diameter drain. Bin is insulated all around with high-density environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane. Ice bin holds 45 pounds of ice.

Exterior body is 24-gauge galvanized steel.

Cutout dimensions are 21" (53 cm) x 17.75" (45 cm).

NSF

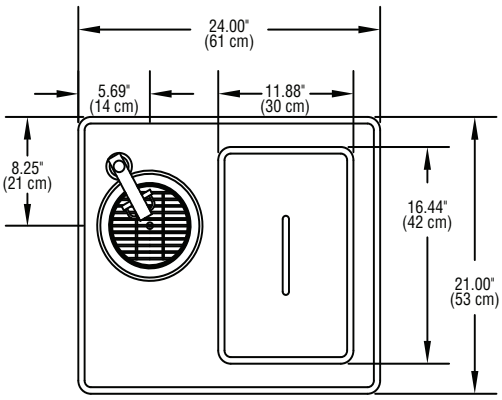
980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948 or 989-773-7981
Fax: 800-669-0619

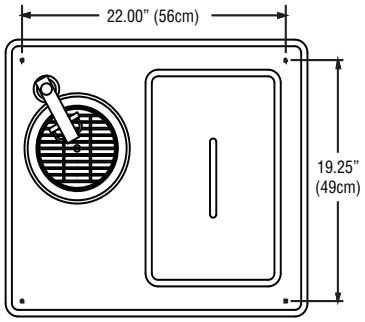
www.delfield.com

Manitowoc

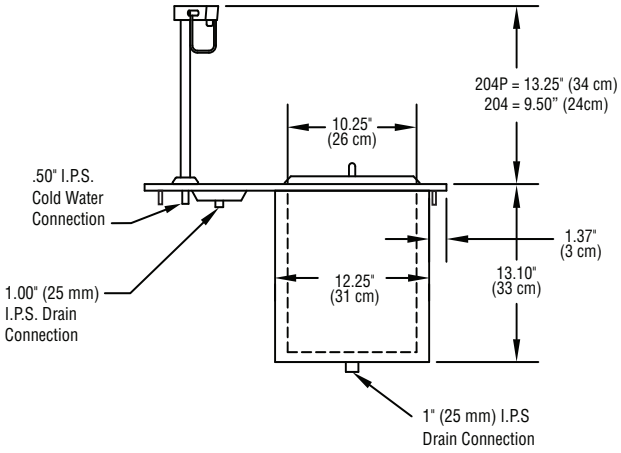
Delfield



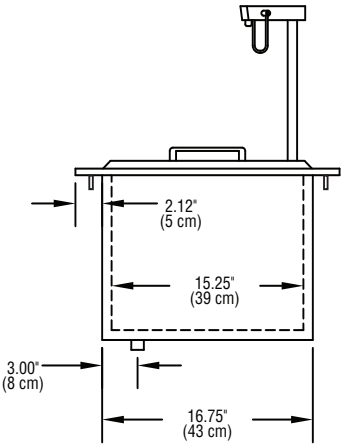
Plan View
204, 204P



Mounting Stud Locations
204, 204P



Elevation View
204, 204P



Side View
204, 204P

204 Series Water And Ice Station

Specifications						
Model	L	D	H	Cutout Size	Cabinet Capacity	Ship Weight
204	24″ (61 cm)	21″ (53 cm)	22.6″ (57 cm)	21″ x 17.75″ (53 cm x 45 cm)	45lbs (20kg)	47.5lbs (22kg)
204P	24″ (61 cm)	21″ (53 cm)	26.35″ (67 cm)	21″ x 17.75″ (53 cm x 45 cm)	45lbs (20kg)	47.5lbs (22kg)

Delfield reserves the right to make changes to the design or specifications without prior notice.

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948 or 989-773-7981
Fax: 800-669-0619
www.delfield.com

Printed in the U.S.A.
DS204_204P
12/12

Manitowoc

APPLICATION:

PRODUCT NAME:

4" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

☐ 3515 W/ 12" SWIVEL GOOSENECK SPOUT

☐ 3525 W/ 6" SWIVEL GOOSENECK SPOUT

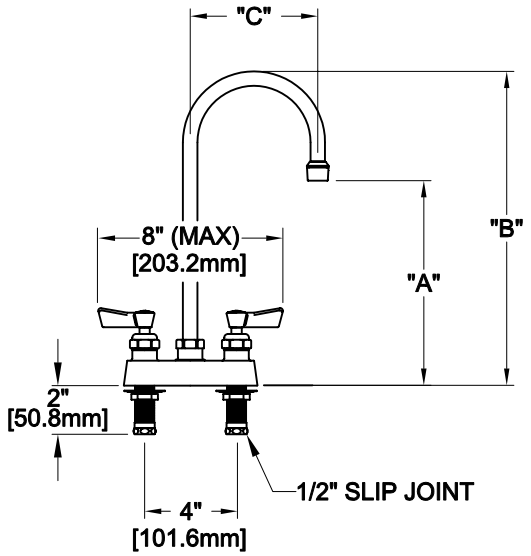
OPTIONS OR MODIFICATIONS:

☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH

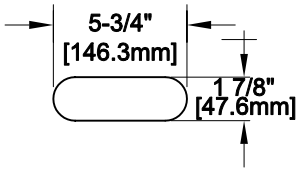
☐ VANDAL RESISTANT KIT

☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE

☐ OTHER _____

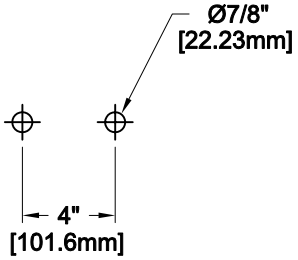


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3515	8-1/2" [215.9mm]	12-1/2" [317.5mm]	5-1/2" [139.7mm]
3525	4-3/4" [120.7mm]	8-3/8" [212.7mm]	3-1/2" [88.90mm]

ROUGH-IN:



FEATURES:

* 4" C/C DECK MOUNT
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT

SYSTEM LIMITS

* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 4.75 LBS

ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3515 REV. D

Project _____

Item # _____

Quantity _____

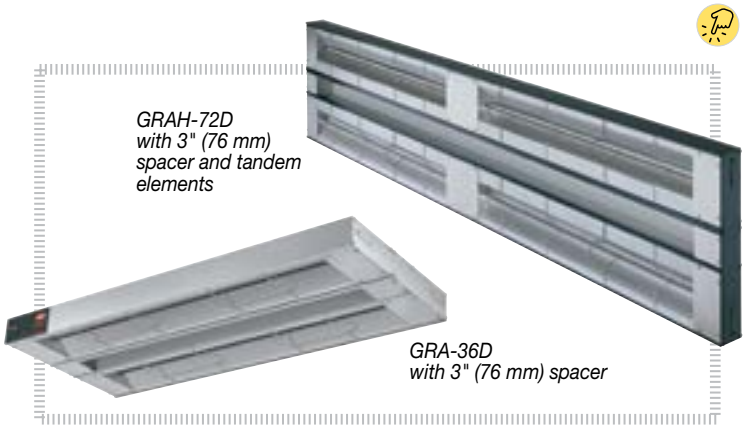
Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models:

GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

Create a deeper holding area with Glo-Ray® Aluminum Dual Infrared Foodwarmers with two heaters mounted side-by-side, keeping hot food at optimum serving temperatures. The pre-focused heat pattern directs heat from a metal sheathed element across the entire holding surface. The continuous aluminum housing and heavy-duty mountings ensure the durability and quality of Hatco products.



Standard features

- Provides even heat distribution – no “cold spots”
- Pre-focused heat maintains safe serving temperatures longer
- Sturdy extruded aluminum housings that do not sag, from 18" to 144" (457 to 3658 mm)
- Reflector does not blacken, maintaining a consistent heat pattern
- Reinforced wire guards provide operator safety without affecting heat distribution
- 3" or 6" (76 or 152 mm) spacer available as a center section between two 6" (152 mm) heater sections for a deeper holding area
- Heavy-duty insulation minimizes heat loss
- Optional sneeze guard made of shatterproof, easy-to-clean acrylic provide safe food serving environment
- Additional reflector styles and lower wattage elements also available, please consult factory for more information
- Metal sheathed heating element part guaranteed against burnout and breakage for two years

Options (available at time of purchase only)

Housing – clear Anodized finish Standard
☐ 15" (4572 mm) ☐ 18" (457 mm)
Designer Color or Gloss Finish⊗▪
☐ Warm Red ☐ Black ☐ Gray Granite ☐ White Granite
☐ Navy Blue ☐ Hunter Green ☐ Antique Copper
☐ Radiant Red ☐ Glossy Gray ☐ Bold Black ☐ Gleaming Gold
☐ Brilliant Blue

☐ Indicator Light (Remote only)

Leads – Extended Beyond Standard 3' (914 mm) Conduit
Please specify lead length
☐ 1'-5' (305-1525 mm) ☐ 6'-10' (1829-3048 mm)
☐ 11'-15' (3352-4572 mm) ☐ 16'-20' (4877-6096 mm)

Sneeze Guard
☐ 9.375" (238 mm) – One Side ☐ 9.375" (238 mm) – Two Sides
☐ 14" (356 mm) – One Side ☐ 14" (356 mm) – Two Sides

☐ Remote Infinite Switches in lieu of Toggle (max. 12.2 amps)

☐ Remote Toggle Switches (max. 15 amps)

☐ Remote Box (RMB) – clear Anodized finish Standard
Designer Color or Gloss Finish⊗▪
☐ Warm Red ☐ Black ☐ Gray Granite ☐ White Granite
☐ Navy Blue ☐ Hunter Green ☐ Antique Copper
☐ Radiant Red ☐ Glossy Gray ☐ Bold Black ☐ Gleaming Gold
☐ Brilliant Blue

☐ Factory attaches Control Box to Strip Heater (Export only)

☐ Adjustable Tubular Stands 10"-14" (254-356 mm)
(not available in *Designer* Colors)

Non-Adjustable Tubular Stands – matches housing color – Choose clearance below⊗▪
☐ 10" (254 mm) ☐ 12" (305 mm) ☐ 14" (356 mm) ☐ 16" (406 mm)

Accessories

Adjustable Angle Brackets (with clearance above unit)
☐ 1"-2" (25-51 mm) ☐ 7" (178 mm) - GRA-xxD models only

☐ Chain Suspension

⊗ Non-standard colors are non-returnable

NOTE: Install Remote Box outside Heat Zone or damage will occur.

▪ **IFS anti-microbial coatings use naturally-occurring, environmentally sustainable, silver ions to help inhibit the growth of microbes on the powder coated surface. See www.hatcocorp.com/antimicrobial-paint for more information.**

For operation, location and safety information, please refer to the Installation and Operating Manual.

MADE IN THE USA

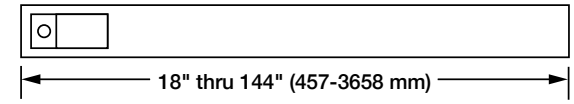
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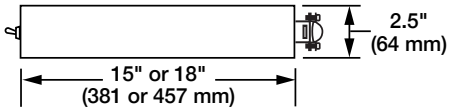
Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

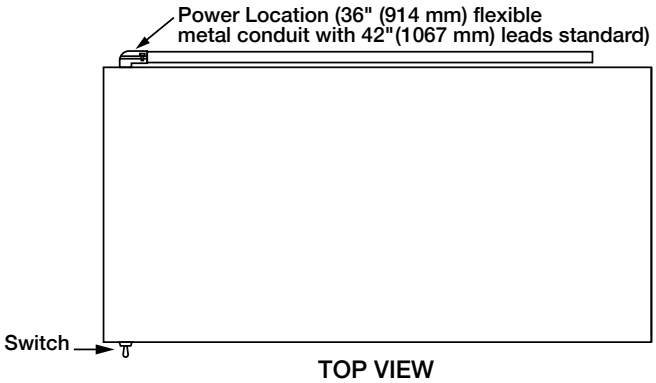
GRA-D and GRAH-D



FRONT VIEW (width)



END VIEW (depth)



TOP VIEW

Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Width
GRA-18D	120	500	4.2	14 lbs. (7 kg.)	GRAH-18D	120	700	5.8	14 lbs. (7 kg.)	18" (457 mm)
	208		2.4			208		3.4		
	240		2.1			240		2.9		
	–	–	–			100	700	7.0		
	200	462	2.5			200	647	3.5		
	220	500	1.1			220	700	3.2		
	220-230 (CE)‡	500-546	2.3-2.4			220-230 (CE)‡	700-765	3.2-3.3		
	230-240 (CE)‡	459-500	2.0-2.1			230-240 (CE)‡	643-700	2.8-2.9		
	240	500	1.0			240	700	2.9		
GRA-24D	120	700	5.8	16 lbs. (8 kg.)	GRAH-24D	120	1000	8.3	16 lbs. (8 kg.)	24" (610 mm)
	208		3.4			208		4.8		
	240		2.9			240		4.2		
	–	–	–			100	1000	10.0		
	200	647	1.8			200	925	5.0		
	220	700	1.6			220	1000	4.5		
	220-230 (CE)‡	700-765	3.2-3.3			220-230 (CE)‡	1000-1093	4.5-4.8		
	230-240 (CE)‡	643-700	2.8-2.9			230-240 (CE)‡	918-1000	4.0-4.2		
	240	700	1.5			240	1000	4.2		
GRA-30D	120	900	7.5	18 lbs. (9 kg.)	GRAH-30D′	120	1320	11.0	18 lbs. (9 kg.)	30" (762 mm)
	208		4.3			208		6.3		
	240		3.8			240		5.5		
	–	–	–			100	1320	13.2		
	200	832	2.3			200	1220	6.6		
	220	900	2.1			220	1320	6.0		
	220-230 (CE)‡	900-984	4.1-4.3			220-230 (CE)‡	1320-1443	6.0-6.3		
	230-240 (CE)‡	827-900	3.6-3.8			230-240 (CE)‡	1212-1320	5.3-5.5		
	240	900	1.9			240	1320	5.5		
GRA-36D	120	1150	9.6	19 lbs. (9 kg.)	GRAH-36D′	120	1600	13.3	19 lbs. (9 kg.)	36" (914 mm)
	208		5.5			208		7.7		
	240		4.8			240		6.7		
	–	–	–			100	1600	16.0		
	200	1063	2.9			200	1479	8.0		
	220	1150	2.6			220	1600	7.3		
	220-230 (CE)‡	1150-1257	5.2-5.5			220-230 (CE)‡	1600-1749	7.3-7.6		
	230-240 (CE)‡	1056-1150	4.6-4.8			230-240 (CE)‡	1469-1600	6.4-6.7		
	240	1150	4.8			240	1600	6.7		
GRA-42D′	120	1350	11.3	23 lbs. (11 kg.)	GRAH-42D′	120	1900	15.8	24 lbs. (11 kg.)	42" (1067 mm)
	208		6.5			208		9.1		
	240		5.6			240		7.9		
	–	–	–			100	1900	19.0		
	200	1248	6.8			200	1757	9.5		
	220	1350	6.1			220	1900	8.6		
	220-230 (CE)‡	1350-1476	6.1-6.4			220-230 (CE)‡	1900-2077	8.6-9.0		
	230-240 (CE)‡	1240-1350	5.4-5.6			230-240 (CE)‡	1745-1900	7.6-7.9		
	240	1350	5.6			240	1900	7.9		

[a] Shipping weight includes packaging, and does not include RMB.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.
′ 100V and 120V models may require additional switches, consult factory for applications.

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Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA -18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
GRAH -18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Model	Volts	Watt	Amps	Approx. Ship Weight[a]	Width
GRA-48D[b]	120	1600	13.3	27 lbs. (12 kg.)	GRAH-48D[b]	120	2200	18.3	27 lbs. (12 kg.)	48" (1219 mm)
	208		7.7			208		10.6		
	240		6.7			240		9.2		
	–	–	–			100	2200	22.0		
	200	1479	8.0			200	2034	11.0		
	220	1600	7.3			220	2200	10.0		
	220-230 (CE)‡	1600-1749	7.3-7.6			220-230 (CE)‡	2200-2405	10.0-10.5		
	230-240 (CE)‡	1469-1600	6.4-6.7			230-240 (CE)‡	220-2200	8.8-9.2		
	240	1600	6.7			240	2200	9.2		
GRA-54D[b]	120	1850	15.4	30 lbs. (14 kg.)	GRAH-54D[b]	120	2500	20.8	30 lbs. (14 kg.)	54" (1372 mm)
	208		8.9			208		12.0		
	240		7.7			240		10.4		
	–	–	–			100	2500	25.0		
	200	1710	9.3			200	2311	12.5		
	220	1850	8.4			220	2500	11.4		
	220-230 (CE)‡	1850-2022	8.4-8.8			220-230 (CE)‡	2500-2732	11.4-11.9		
	230-240 (CE)‡	1699-1850	7.4-7.7			230-240 (CE)‡	2296-2500	10.0-10.4		
	240	1850	7.7			240	2500	10.4		
GRA-60D[b]	120	2100	17.5	35 lbs. (16 kg.)	GRAH-60D[b]	120	2800	23.3	34 lbs. (16 kg.)	60" (1524 mm)
	208		10.1			208		13.5		
	240		8.8			240		11.7		
	–	–	–			100	2800	28.0		
	200	1942	10.5			200	2589	14.0		
	220	2100	9.5			220	2800	12.7		
	220-230 (CE)‡	2100-2295	9.5-10.0			220-230 (CE)‡	2800-3060	12.7-13.3		
	230-240 (CE)‡	1929-2100	8.4-8.8			230-240 (CE)‡	2572-2800	11.2-11.7		
	240	2100	8.8			240	2800	11.7		
GRA-66D[b]	120	2320	19.3	36 lbs. (17 kg.)	GRAH-66D[c][b]	120	3120	26.0	38 lbs. (18 kg.)	66" (1676 mm)
	208		11.2			208		15.0		
	240		9.7			240		13.0		
	–	–	–			100	3120	31.2		
	200	2145	11.6			200	2885	15.6		
	220	2320	10.5			220	3120	14.2		
	220-230 (CE)‡	2320-2536	10.5-11.0			220-230 (CE)‡	3120-3410	14.2-14.8		
	230-240 (CE)‡	2131-2320	9.3-9.7			230-240 (CE)‡	2865-3120	12.5-13.0		
	240	2320	9.7			240	3120	13.0		
GRA-72D[c][b]	120	2550	21.3	36 lbs. (17 kg.)	GRAH-72D[c][b]	120	3450	28.8	36 lbs. (17 kg.)	72" (1829 mm)
	208		12.3			208		16.6		
	240		10.6			240		14.4		
	–	–	–			100	3450	34.5		
	200	2358	12.8			200	3190	17.3		
	220	2550	11.6			220	3450	15.7		
	220-230 (CE)‡	2550-2787	11.6-12.1			220-230 (CE)‡[⊙]	3450-3771	15.7-16.4		
	230-240 (CE)‡	2342-2550	10.2-10.6			230-240 (CE)‡[⊙]	3168-3450	13.8-14.4		
	240	2550	10.6			240	3450	14.4		
GRA-84D[c][b]	120	3000	25.0	50 lbs. (23 kg.)	GRAH-84D[⚯][b]	120	4100	34.2	50 lbs. (23 kg.)	84" (2134 mm)
	208		14.4			208		19.7		
	240		12.5			240		17.1		
	–	–	–			100	4100	41.0		
	200	2774	15.0			200	3791	20.5		
	220	3000	13.6			220	4100	18.6		
	220-230 (CE)‡	3000-3279	13.6-14.3			220-230 (CE)‡[⊙]	4100-4481	18.6-19.5		
	230-240 (CE)‡	2755-3000	12.0-12.5			230-240 (CE)‡[⊙]	3766-4100	16.4-17.1		
	240	3000	12.5			240	4100	17.1		
GRA-96D[c][b]	120	3450	28.8	52 lbs. (24 kg.)	GRAH-96D[⚯][b]	120	4800	40.0	52 lbs. (24 kg.)	96" (2438 mm)
	208		16.6			208		23.1		
	240		14.4			240		20.0		
	–	–	–			100	4800	48.0		
	200	3190	17.3			200	4438	24.0		
	220	3450	15.7			220	4800	21.8		
	220-230 (CE)‡[⊙]	3450-3771	15.7-16.4			220-230 (CE)‡[⊙]	4800-5246	21.8-22.8		
	230-240 (CE)‡[⊙]	3169-3450	13.8-14.4			230-240 (CE)‡[⊙]	4408-4800	19.2-20.0		
	240	3450	14.4			240	4800	20.0		

[a] Shipping weight includes packaging, and does not include RMB.
[b] 100V and 120V models may require additional switches, consult factory for applications.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.
[c] 100V and 120V models with infinite switch require tandem (end-to-end) elements, consult factory for applications.
[⚯] Contain tandem (end-to-end) elements that may be individually controlled.
[⊙] Available with RMB or remote switch only. Consult factory for additional charges.

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Glo-Ray® Aluminum Dual Infrared Strip Heaters

Models: GRA-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D
GRAH-18D, -24D, -30D, -36D, -42D, -48D, -54D, -60D, -66D, -72D, -84D, -96D, -108D, -120D, -132D, -144D

Glo-Ray® Dual Infrared Aluminum Strip Heaters

Dimensions: with 3" (76 mm) Spacer: 18" - 144 W x 15" D x 2.5" H (457 - 3658 x 381 x 64 mm)
with 6" (152 mm) Spacer: 18" - 144 W x 18" D x 2.5" H (457 - 3658 x 457 x 64 mm)

Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical nformation for International models

Standard Watt					High Watt					Both Models
Model	Volts	Watt	Amps	Approx. Ship Weight▲	Model	Volts	Watt	Amps	Approx. Ship Weight▲	Width
GRA-108D ⁄†⊙✖	120	3700	30.8	59 lbs. (27 kg.)	GRAH-108D ⁄†⊙✖	120	5000	41.7	59 lbs. (27 kg.)	108" (2743 mm)
	208		17.8			208		24.0		
	240		15.4			240		20.8		
	220	3700	16.8			220	5000	22.7		
	220-230	3700-4044	16.8-17.6			220-230	5000-5465	22.7-23.8		
	230-240	3398-3700	14.8-15.4			230-240	4592-5000	20.0-20.8		
	240	3700	15.4			240	5000	20.8		
GRA-120D ⁄†⊙✖	120	4200	35.0	66 lbs. (30 kg.)	GRAH-120D ⁄†⊙✖	120	5600	–	66 lbs. (30 kg.)	120" (3048 mm)
	208		20.2			208		26.9		
	240		17.5			240		23.3		
	220	4200	19.1			220	5600	28.0		
	220-230	4200-4591	19.1-20.0			220-230	5600-6121	25.5-26.6		
	230-240	3857-4200	16.8-17.5			230-240	5143-5600	23.4-23.3		
	240	4200	17.5			240	5600	23.3		
GRA-132D ⁄†⊙✖	120	4640	38.7	73 lbs. (34 kg.)	GRAH-132D†⊙✖	–	6240	–	73 lbs. (34 kg.)	132" (3353 mm)
	208		22.3			208		30.0		
	240		19.3			240		26.0		
	220	4640	21.1			220	6240	28.4		
	220-230	4640-5071	21.1-22.0			220-230	6240-6820	28.4-29.7		
	230-240	4261-4640	18.5-19.3			230-240	5731-6240	24.9-26.0		
	240	4640	19.3			240	6240	26.0		
GRA-144D ⁄†⊙✖	120	5100	42.3	80 lbs. (37 kg.)	GRAH-144D†⊙✖	–	6900	–	80 lbs. (37 kg.)	144" (3658 mm)
	208		24.5			208		33.2		
	240		21.3			240		28.8		
	220	5100	23.2			220	6900	341.4		
	220-230	5100-5574	23.2-24.3			220-230	6900-7542	31.4-32.8		
	230-240	4684-5100	20.4-21.3			230-240	6337-6900	27.6-28.8		
	240	5100	21.3			240	6900	28.8		

▲ Shipping weight includes packaging, and does not include RMB.
✖ CE not available.
⁄ 100V and 120V models may require additional switches, consult factory for applications.
† Glo-Ray models 108"-144" (2743-3658 mm) and 120 volt models of GRAH-84 and GRAH-96 contain tandem (end-to-end) elements that may be individually controlled.
⊙ Available with RMB (Remote Box) or remote switch only. Consult factory for additional charges.

TOGGLE SWITCH: Amps: Max. 15 amps. Location: Chef's left side.

INFINITE SWITCH: Max. 12.2 amps Location: remote installation only

CONDUIT: 3' (914 mm) conduit standard on 120V and 208V models only

LEADS: **US/Canada:** 6" (152 mm) leads, server's right side
Euro/UK GRAH-xxD: 6" (152 mm) pigtail leads with no conduit, servers right side

RECOMMENDED MOUNTING HEIGHTS

(Refer to the Installation section of the Manual on the Hatco website)

Units with 3" (76 mm) and 6" (152 mm) Spacers

Standard Watt: 10"-14" (254-356 mm) **High Watt:** 14"-18" (356-457 mm)

MINIMUM CLEARANCES

Combustibles

Cannot be installed in combustible surroundings

Non-Combustibles

Dual Units with Built-In Switches

Unit to surface below: 10" (254 mm)
Must be installed in pass through area, back wall installation not allowed
Below overshelf: 1" (25 mm) clearance

Dual Units with Remote Switches:

Unit to surface below: 8" (203 mm)
Unit to wall: 3" (76 mm)
Below overshelf: 0" (0 mm) clearance, can be flush to an overshelf

REMOTE CONTROL ENCLOSURES

Must order one RMB control box per Strip Heater - If RMB2 is used, multiple warmers can be controlled from one box.

Click here to download the RMB Choose Remote Box Excel Spreadsheet
or follow this file path: www.hatcocorp.com > Resources > Choose Remote Box

Model	Width	Toggle Switches
RMB-3	6" (150 mm)	2 maximum
RMB-7	9.375" (239 mm)	4 maximum
RMB-14	14.375" (366 mm)	6 maximum
RMB-16	16.375" (417 mm)	3 maximum
RMB-20	20.375" (518 mm)	4 maximum
RMB2-1R	11" (279 mm)	1 toggle, 1 infinite, 1 relay, 1 indicator light
RMB2-2R	14" (356 mm)	1 toggle, 1 infinite, 2 relays, 1 indicator light



Model RMB-14E with infinite controls



RMB-3F with toggle switch and indicator light

PRODUCT SPECS

Infrared Foodwarmers

The Aluminum Dual Infrared Foodwarmer shall be a Glo-Ray®, manufactured by the Hatco Corporation, Milwaukee,WI 53234 U.S.A.

The Foodwarmer shall be a Glo-Ray model ... , rated at ... watts, ... volts, single phase, and be ... inches (millimeters) in overall width. The Glo-Ray shall consist of an aluminum housing and include four shelf mounting tabs, and 3' (914 mm) conduit with leads.

The infrared heating element shall be tubular metal sheathed. The foodwarmer shall be factory-assembled ready for electrical installation.

Options and accessories shall include adjustable or non-adjustable tubular stand, angle brackets, suspension chain and fittings, sneeze guard and indicator light. Housing and RMB shall be offered in Optional *Designer* Color and Gloss Finish anti-microbial paint.

Warranty consists of 24/7 parts and service assistance (U.S. and Canada only).

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

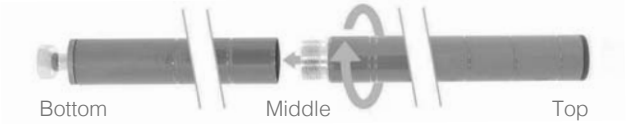
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

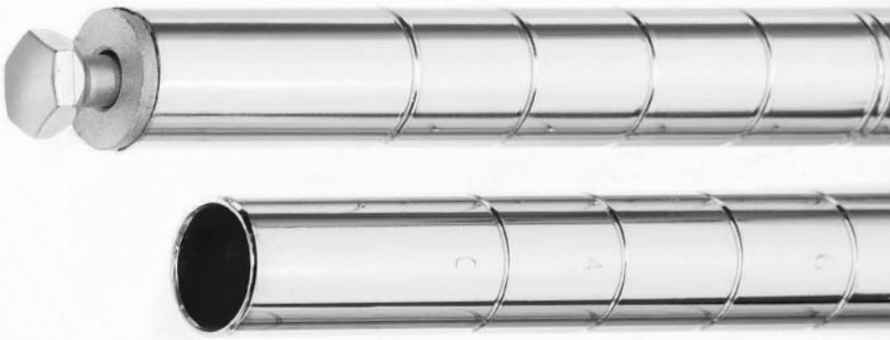
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

SHELVES

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
14x24	457x760	7.8	3.5	C1424C	C1424K
14x30	457x914	9.5	4.2	C1430C	C1430K
14x36	457x1060	11.3	5.0	C1436C	C1436K
14x42	457x1219	13.0	5.8	C1442C	C1442K
14x48	457x1372	14.8	6.6	C1448C	C1448K
14x60	457x1524	16.5	7.4	C1460C	C1460K
14x72	457x1829	19.8	8.8	C1472C	C1472K
18x24	457x610	8.0	3.6	C1824C	C1824K
18x30	457x760	7.8	3.5	C1830C	C1830K
18x36	457x914	9.5	4.2	C1836C	C1836K
18x42	457x1060	11.3	5.0	C1842C	C1842K
18x48	457x1219	13.0	5.8	C1848C	C1848K
18x54	457x1372	14.8	6.6	C1854C	C1854K
18x60	457x1524	16.5	7.4	C1860C	C1860K
18x72	457x1829	19.8	8.8	C1872C	C1872K
21x24	530x610	8.0	3.6	C2124C	C2124K
21x30	530x760	9.5	4.2	C2130C	C2130K
21x36	530x914	11.3	5.0	C2136C	C2136K
21x42	530x1060	12.5	5.6	C2142C	C2142K
21x48	530x1219	14.3	6.4	C2148C	C2148K
21x54	530x1372	16.5	7.4	C2154C	C2154K
21x60	530x1524	18.3	8.1	C2160C	C2160K
21x72	530x1829	21.5	9.6	C2172C	C2172K
24x24	610x610	9.5	4.2	C2424C	C2424K
24x30	610x760	11.3	5.0	C2430C	C2430K
24x36	610x914	13.0	5.8	C2436C	C2436K
24x42	610x1060	14.0	6.3	C2442C	C2442K
24x48	610x1219	15.5	6.9	C2448C	C2448K
24x54	610x1372	18.3	8.1	C2454C	C2454K
24x60	610x1524	20.0	8.9	C2460C	C2460K
24x72	610x1829	23.3	10.4	C2472C	C2472K

Note: Each shelf up to and including 48" (1219mm) long have a maximum weight capacity of 800 lbs. (363kg) evenly distributed. Shelves longer than 48" (1219mm) have a maximum weight capacity of 600 lbs. (272kg) evenly distributed.

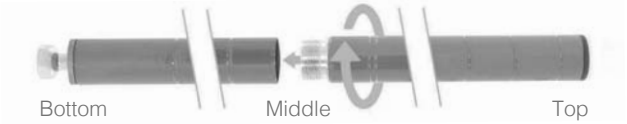
POSTS (STATIONARY)

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.7	0.3	C7C	C7K
13	330	0.9	0.4	C13C	C13K
33	838	2	0.9	C33C	C33K
54	1372	3.4	1.5	C54C	C54K
63	1600	3.6	1.6	C63C	C63K
74	1880	4.1	1.9	C74C	C74K
86	2184	4.8	2.2	C86C	C86K

SPLIT POSTS

4 pack of 2-piece posts for a single shelving unit.

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
74	1880	16.4	7.6	C74TSPC-4PK	C74TSPK-4PK



POSTS (MOBILE)

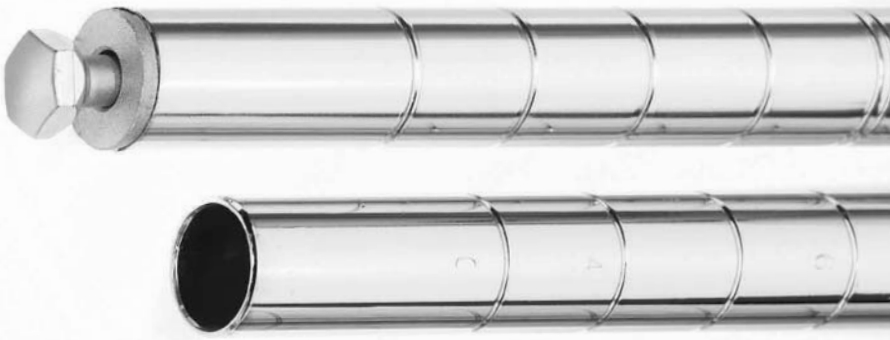
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Chromate	Cat. No. Epoxy Coating
7	178	0.6	0.3	C7UC	C7UK
13	330	0.8	0.4	C13UC	C13UK
33	838	1.9	0.9	C33UC	C33UK
54	1372	3.3	1.5	C54UC	C54UK
63	1600	3.5	1.6	C63UC	C63UK
74	1880	4	1.8	C74UC	C74UK
86	2184	4.7	2.1	C86UC	C86UK

NSF

AVAILABLE IN POS KITS
See Page 6



Stationary Post with adjustable leveling foot
Use Foot Plates for greater stability.



Stem Caster Mobile Post accepts standard stem casters. Use these for the majority of standard duty transport and movable storage applications.

See Casters on Next Page ▸

Delfield®

4448NP

Front-Breathing Self-Contained Flat Top Refrigerated Bases

Models

- 4448NP Single Section with Doors
- D4448NP Single Section with Drawers
- ST4448NP Single Section with Doors with Backsplash
- STD4448NP Single Section with Drawers with Backsplash



4448NP

Standard Features

- All 4400 Series units are 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet, or an existing lineup.
- Durable, rugged stainless-steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable – it won't dent, chip or corrode and is backed by a limited lifetime warranty.
- "D" prefix models feature Delfield's new drawer system. Drawers are backed by a lifetime warranty on the track assembly.
- Bent in full length handle on doors and drawers.
- Standard on 5" casters for easy cleaning and installation
- One wire shelf standard, installed per door section.
- ACT solid state electronic control
- Environmentally friendly R290 refrigerant
- High density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low.
- 10' cord and plug supplied
- Three-year parts and labor warranty and a seven-year compressor parts warranty

Options & Accessories

- 18" wide single tier over shelf
- Stainless steel finish on back
- Cutting Boards
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height available
- Door lock
- Exterior thermometer (some models excluded)

Specifications

Exterior top is one-piece, 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. ST and STD models have standard backsplash, full width and 4" (10cm) tall.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel. Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of cabinet. Evaporator coil is located on the interior rear wall of cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior temperature of 33°F to 41°F (0°C to 4°C).

ACT control: ACT electronic, solid-state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connection is 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15 plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking brakes. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-guage stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable wire shelf.

Drawers have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Top drawer holds one full size 12" x 20", 4"-6" (30.5cm x 50.8cm x 10.2cm) deep pan, and three 1/6 size pans. Bottom drawer holds one full size 12" x 20" and three 1/6 size, 4" deep pans. Pans are supplied by others.

R290

4448NP Flat Top Refrigerated Bases

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

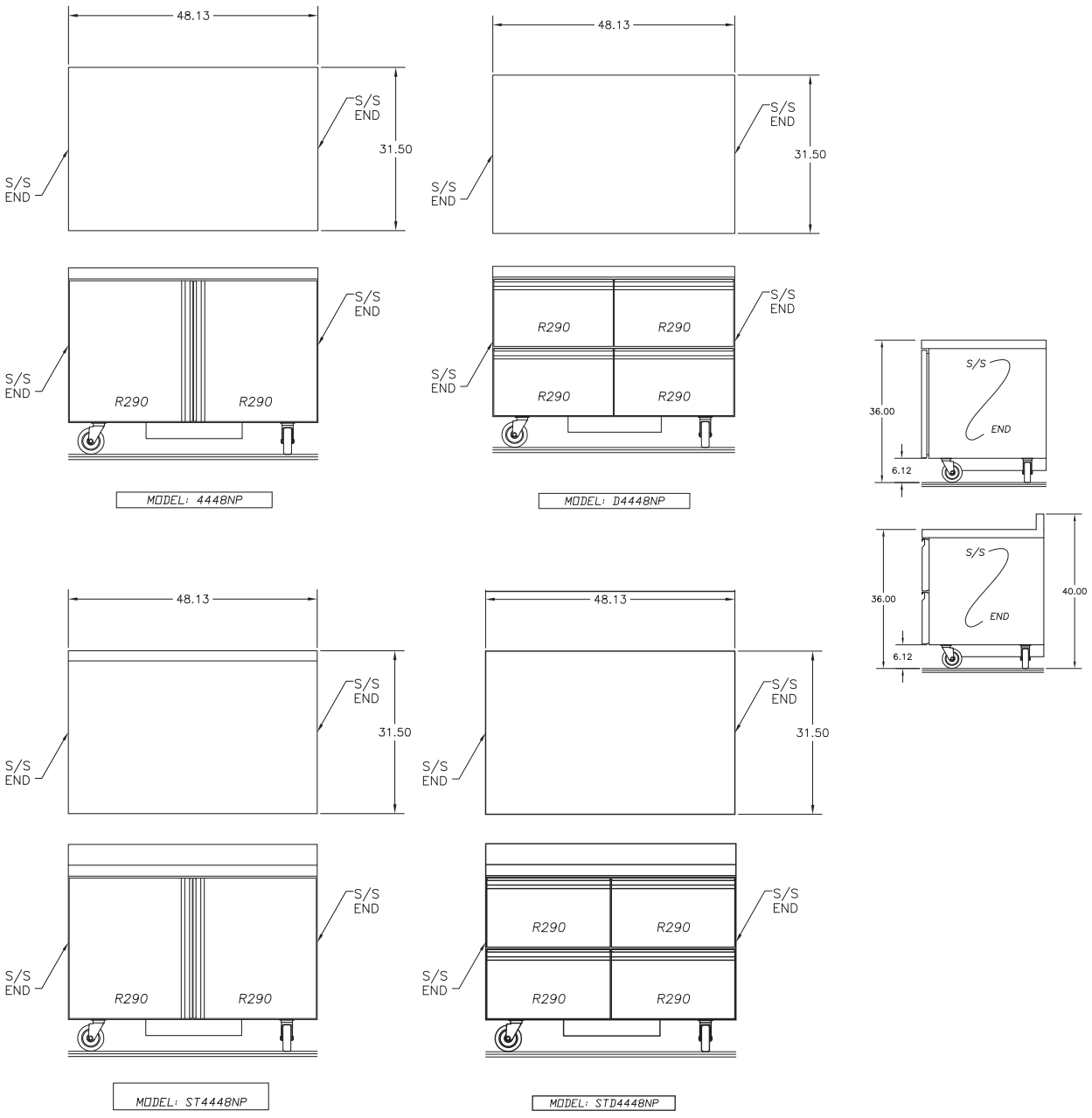
Phone: 800-733-8948 or 989-773-7981
Fax: 800-669-0619

www.delfield.com
4448NP_Spec
07/23

Delfield®

Delfield®

4448NP Flat Top Refrigerated Bases



Specifications

Model	# of Shelves	Shelf Area	Storage Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
D4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg
ST4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	5-15P	316lbs/143kg
STD4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	5-15P	398lbs/181kg

Welbilt reserves the right to make changes to the design or specifications without prior notice.

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4448NP_Spec
07/23

Delfield®

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

102920

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PB-DISINK1014" PRO-BOWL DROP-IN HAND SINK

1 BOWL

FEATURES:

- ONE PIECE DEEP DRAWN BOWL
- ALL SINK BOWLS HAVE LARGE LIBERAL RADII CORNERS
- INCLUDES BASKET DRAIN
- DECK MOUNT FAUCET HOLES - 4" ON-CENTER

MATERIAL:

- BOWL: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH
- BRACKET: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH

CONSTRUCTION:

- BOWL: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.



PB-DISINK101405



PB-DISINK101405-SSLR



PB-DISINK101405-P-SSLR



PB-DISINK101410



PB-DISINK101410-SSLR



PB-DISINK101410-P-SSLR

PRO-BOWL DROP-IN HAND SINKS

MODEL #	QTY
PB-DISINK101405	
PB-DISINK101405-SSLR	
PB-DISINK101405-P-SSLR	
PB-DISINK101410	
PB-DISINK101410-SSLR	
PB-DISINK101410-P-SSLR	

CALL FACTORY FOR CUT OUT SIZES.

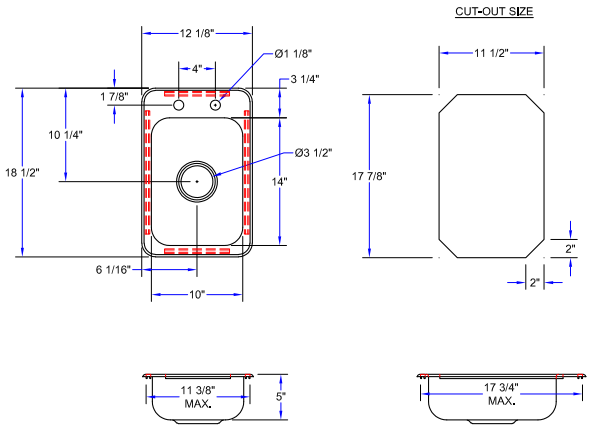
OPTIONAL ACCESSORIES

DESCRIPTION	QTY
FAUCETS	
SIDE SPASH	
ADA WRIST BLADES	
TOWEL DISPENSER	
LEVER WASTES	
OVER FLOWS	
P-TRAPS	

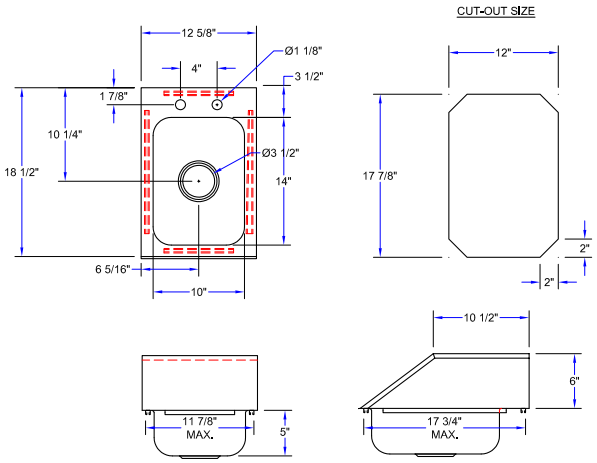
780

DETAILED SPECIFICATIONS

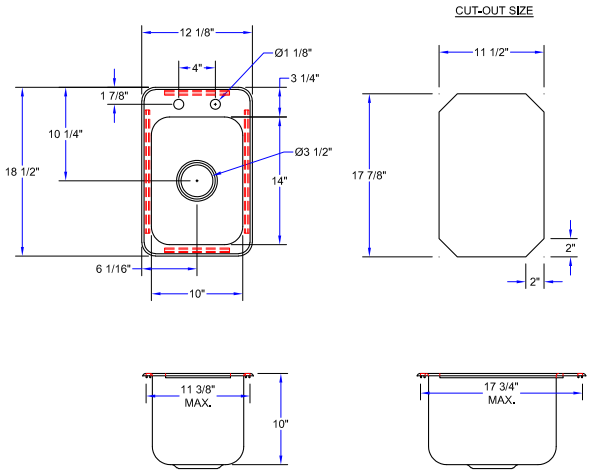
PB-DISINK101405



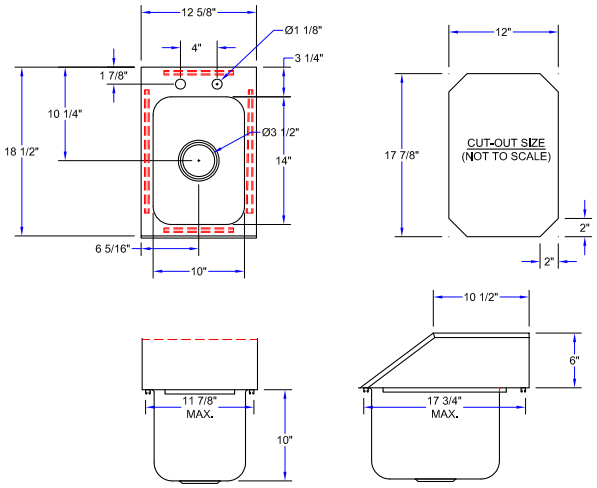
PB-DISINK101405-SSLR



PB-DISINK101410



PB-DISINK101410-SSLR



PRO-BOWL DROP-IN HAND SINKS

MODEL #	BOWL SIZE (LxWxD)	SINK SIZE (LxWxD)	CERTIFICATION	SIDE SPLASH
PB-DISINK101405	10" X 14" X 5"	12-1/4" X 18" X 5"	NSF COMPONENT, CSA	N/A
PB-DISINK101405-SSLR	10" X 14" X 5"	12-3/8" X 18-1/2" X 5"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101405-P-SSLR (INCLUDES: PBF-4-DLF)	10" X 14" X 5"	12-3/8" X 18-1/2" X 5"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101410	10" X 14" X 10"	12-1/4" X 18" X 10"	NSF COMPONENT, CSA	N/A
PB-DISINK101410-SSLR	10" X 14" X 10"	12-1/2" X 18-3/4" X 10"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101410-P-SSLR (INCLUDES: PBF-4-DLF)	10" X 14" X 10"	12-1/2" X 18-3/4" X 10"	NSF COMPONENT, CSA	LH & RH

** SUGGESTED CUTOUT. VERIFY WITH PHYSICAL SINK DIMENSIONS FOR CUTOUT SIZE.
** WEIGHTS ARE SUBJECT TO ADDITIONAL PACKAGING

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

PRODUCT NAME:

4" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

☐ 3515 W/ 12" SWIVEL GOOSENECK SPOUT

☐ 3525 W/ 6" SWIVEL GOOSENECK SPOUT

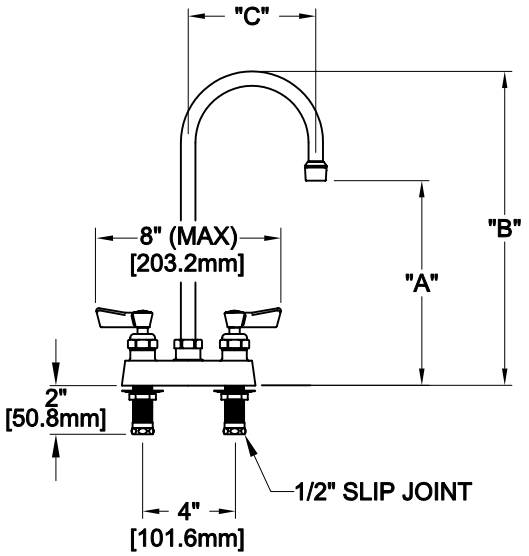
OPTIONS OR MODIFICATIONS:

☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH

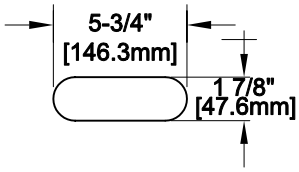
☐ VANDAL RESISTANT KIT

☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE

☐ OTHER _____

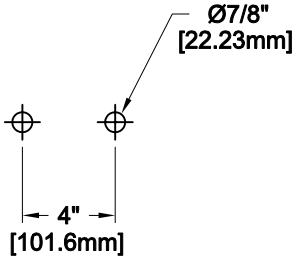


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3515	8-1/2" [215.9mm]	12-1/2" [317.5mm]	5-1/2" [139.7mm]
3525	4-3/4" [120.7mm]	8-3/8" [212.7mm]	3-1/2" [88.90mm]

ROUGH-IN:



FEATURES:

* 4" C/C DECK MOUNT
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT

SYSTEM LIMITS

* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 4.75 LBS

ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3515 REV. D

Delfield

204 Series

Water And Ice Station

Project _____

Item _____

Quantity _____

CSI Section 11400

Approved _____

Date _____

204 Series: Water And Ice Station

Models

- 204 Water and ice station with glass filler
- 204P Water and ice station with pitcher filler



204

Standard Features

- Top is 18-gauge stainless steel with raised die stamped opening
- Chrome plated wire strainer
- Glass filler is 9.5" high
- Pitcher filler is 13.5" high
- One-piece 20-gauge stainless steel lift-off cover with handle
- Liner of ice bin is high-impact ABS plastic with coved corners
- 1" diameter drain plumbed out the bottom
- High density environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane foam throughout unit
- Exterior tank is made of galvanized steel

Specifications

Top is 18-gauge stainless steel, has 1.37" (3 cm) overhang all around. Glass filler is 9.5" (24 cm) high, over die-stamped drain opening fitted with chrome-plated wire strainer. Pitcher filler is 13.5" (34 cm) high, over die-stamped drain opening fitted with chrome-plated wire strainer. Ice bin opening is die-stamped with .19" (5 mm) raised edges, measures 15.12" x 10.5" (38 cm x 27 cm), has one-piece 20-gauge stainless steel lift-off cover.

Liner of ice bin is high-impact ABS plastic, has rounded corners and is pitched to 1" (25 mm) diameter drain. Bin is insulated all around with high-density environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane. Ice bin holds 45 pounds of ice.

Exterior body is 24-gauge galvanized steel.

Cutout dimensions are 21" (53 cm) x 17.75" (45 cm).

NSF

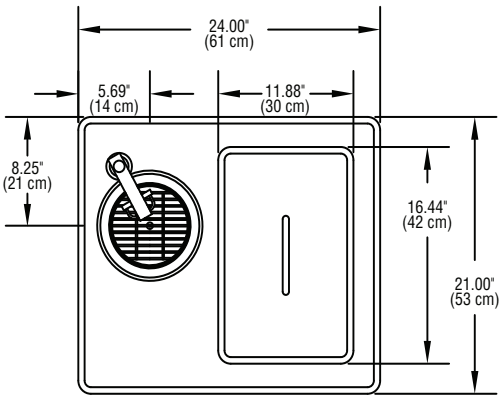
980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948 or 989-773-7981
Fax: 800-669-0619

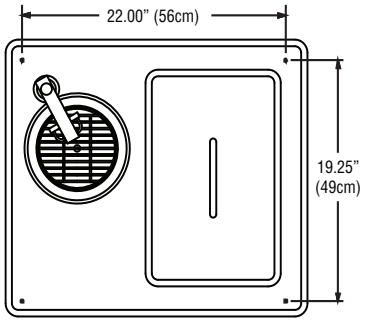
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Manitowoc

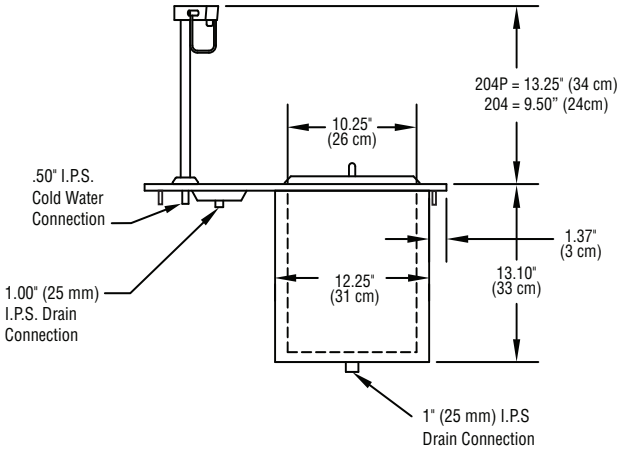
Delfield



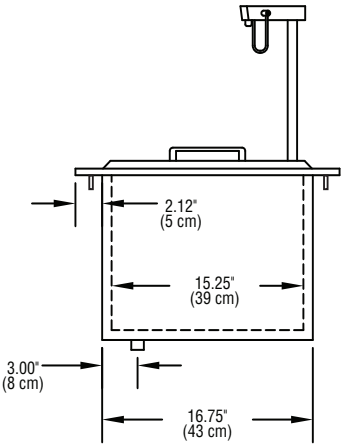
Plan View
204, 204P



Mounting Stud Locations
204, 204P



Elevation View
204, 204P



Side View
204, 204P

204 Series Water And Ice Station

Specifications						
Model	L	D	H	Cutout Size	Cabinet Capacity	Ship Weight
204	24″ (61 cm)	21″ (53 cm)	22.6″ (57 cm)	21″ x 17.75″ (53 cm x 45 cm)	45lbs (20kg)	47.5lbs (22kg)
204P	24″ (61 cm)	21″ (53 cm)	26.35″ (67 cm)	21″ x 17.75″ (53 cm x 45 cm)	45lbs (20kg)	47.5lbs (22kg)

Delfield reserves the right to make changes to the design or specifications without prior notice.

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Printed in the U.S.A.
DS204_204P
12/12

Manitowoc

STEALTH™

CQB1 STEALTH 885



blendtec COMMERCIAL

STEALTH™



BUILT TO SAVE TIME AND MONEY

All Blendtec blenders are built to meet the unique needs of the commercial customer. Each feature - from top to bottom - delivers simple operation and is designed to reduce overall cost.

STEALTH TECHNOLOGY HELPS CREATE A CONVERSATION-FRIENDLY ATMOSPHERE

The Stealth includes a sleek sound enclosure and proprietary airflow innovations that enable operation at the sound level of a normal conversation.

CUSTOMIZABLE CYCLES PROVIDE CONSISTENT RESULTS

In addition to 42 preprogrammed cycles, users can create custom blends with the online Blend Wizard™, then store up to 14 on the blender for one-touch operation.

MOTOR	1800 Watt, 120V / 240V available
INTERFACE	Illuminated OLED display with tactile keypad
WEIGHT	18.1 lbs (8.21 kg)
SOUND ENCLOSURE	Fully enclosed, easy-to-clean blending station. Advanced sound enclosure helps blender operate at the sound level of normal conversation.
USAGE	Recommended daily blends: 200
PROGRAM CYCLES	42 Preprogrammed blend cycles. Create custom or update included blend cycles via Blendtec's Blend WizardTM online tool.
DIMENSIONS	H: 17.3" (43.9 cm) D: 9.0" (22.9 cm) W: 8.6" (21.8 cm)
CERTIFICATIONS	Conforms to applicable UL and CSA safety standards as well as NSF sanitation standards.
OPTIONS	In-counter version available



NSF APPROVED WILDSIDE+ JAR
14 SECONDS
TO AN AMAZING BLENDED DRINK



BLUNT BLADE TECHNOLOGY
STRONGER
THAN TRADITIONAL BLADES



COUNTER-TOP AND IN-COUNTER
OPTIONS
CUSTOM FOR YOUR BUSINESS

blendtec COMMERCIAL

blendtec COMMERCIAL 3 YEAR WARRANTY 1 YEAR LABOR WARRANTY

NSF APPROVED

3X INNOVATION AWARD WINNER

CQB1 STEALTH 885

DELFIELD®

Project _____
Item _____
Quantity _____
CSI Section 11400
Approved _____
Date _____

4448NP Mega Top

Front-Breathing Self-Contained Mega Top Refrigerated Bases

Models

- 4448NP-6M Two section with doors, six pan capacity
- D4448NP-6M Two section with drawers, six pan capacity
- 4448NP-12M Two section with doors, twelve pan capacity
- D4448NP-12M Two section with drawers, twelve pan capacity
- 4448NP-18M Two section with doors, eighteen pan capacity
- D4448NP-18M Two section with drawers, eighteen pan capacity



4448NP-18M
Shown with optional display in nosing.

Standard Features

- Patented air screen ensures product stays cold without drying it out
- 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet or an existing line up
- Durable, rugged stainless steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable - it won't dent, chip or corrode and is backed by a limited lifetime warranty
- Delfield supplies 1/6 size pans and positive placement adapter bars for top opening
- Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance
- Mega top refrigerators are standard with 8" wide, dishwasher safe polyethylene cutting board mounted on heavy-duty brackets
- "D" prefix models feature Delfield's drawer system. Drawers are backed by a 10-year warranty on the track assembly
- Environmentally friendly R290 refrigerant
- High density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low
- Bent in full length handle
- Standard on 5" casters for easy cleaning and installation
- 10' cord and plug supplied
- One epoxy coated wire shelf standard, installed per door section
- ACT solid state electronic control
- Three year parts and labor warranty and an additional two year compressor parts warranty

Options & Accessories

- Various lid options
- 18" wide single tier overshelf
- Stainless steel finish on back
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height
- Door lock
- Exterior thermometer

4448NP Mega Top

980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

Phone: 800-733-8948
Fax: 800-669-0619

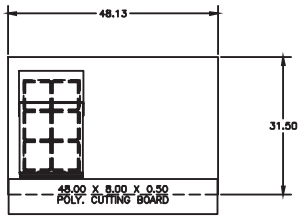
www.delfield.com
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WELBILT®

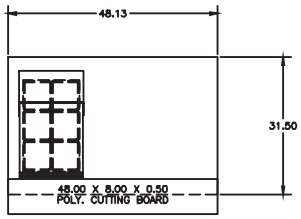
DELFIELD®

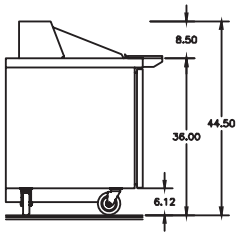
4448NP Mega Top

4448NP-6M Pan Cutout Configuration

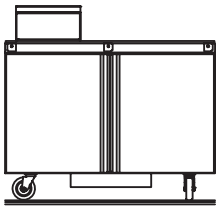


D4448NP-6M Pan Cutout Configuration

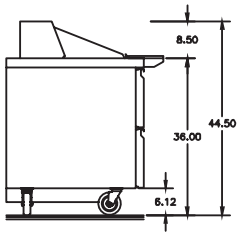




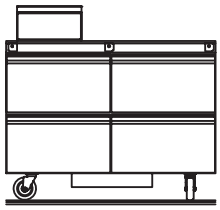
4448NP-6M Left Side View



4448NP-6M Elevation View

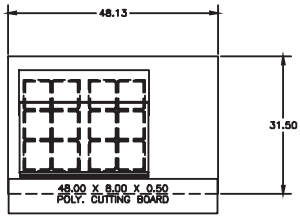


D4448NP-6M Left Side View

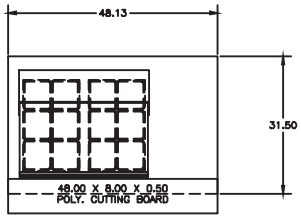


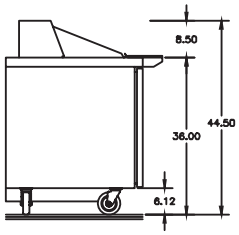
D4448NP-6M Elevation View

4448NP-12M Pan Cutout Configuration

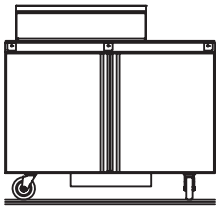


D4448NP-12M Pan Cutout Configuration

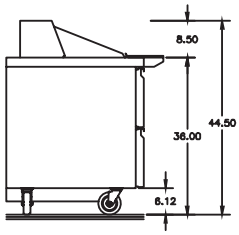




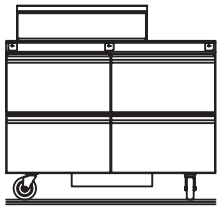
4448NP-12M Left Side View



4448NP-12M Elevation View



D4448NP-12M Left Side View



D4448NP-12M Elevation View

Welbilt reserves the right to make changes to the design or specifications without prior notice.

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Mt. Pleasant, Michigan 48858

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Fax: 800-669-0619

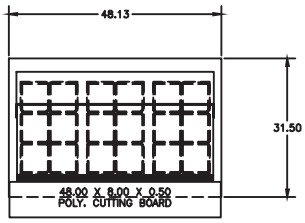
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WELBILT®

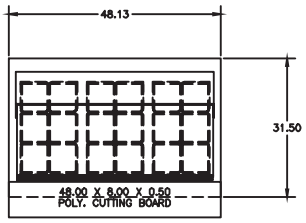
DELFIELD®

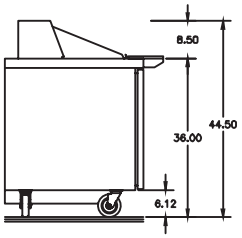
4448NP Mega Top

4448NP-18M Pan Cutout Configuration

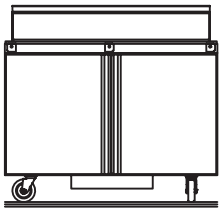


D4448NP-18M Pan Cutout Configuration

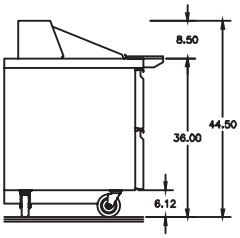




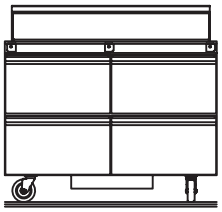
4448NP-18M
Left Side View



4448NP-18M
Elevation View



D4448NP-18M
Left Side View



D4448NP-18M
Elevation View

INSTALLATION NOTE:
Refrigeration system is designed so that air will flow under the unit, through the compressor area and out the front of the unit. Any restriction to this air flow path will void the warranties.

Specifications									
Model	1/6 Size Pan Cap.	# of Shelves	Shelf Area	Volume	h.p.	V/Hz/Ph	Amps	nema plug	Ship Weight
4448NP-6M	6	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-6M	6	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-12M	12	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-12M	12	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg
4448NP-18M	18	1	5.48ft2	16.00ft3	0.3	115/60/1	4.0	5-15P	316lbs/143kg.
D4448NP-18M	18	NA	NA	16.00ft3	0.3	115/60/1	4.0	5-15P	398lbs/181kg

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WELBILT®

DELFIELD®

Specifications

Exterior top is one-piece 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. Top of drawer unit has openings to accept eighteen 1/6 size plastic pans 4" (10cm) deep. Top of door unit has openings to accept eighteen 1/6 size plastic pans 4" or 6" (10cm or 15cm) deep. Adapter bars and 1/6 size pans are supplied by Delfield. Top has one telescoping lid is constructed of 20-gauge stainless steel. Temperature in top openings maintains 33°F (1°C) to 41°F (5°C), with pans recessed 2.5" (6.4cm) at 86°F ambient room temperature, meeting NSF 7 requirements. One 48" x 8" x .5" (121.9cm x 20.3cm x 1.3cm) polyethylene cutting board is mounted on the top at the front edge.

Dual level pan brackets allow the pans to be lowered an additional inch in the unit without tools to provide additional pan temperature holding performance.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel.

Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high-density foamed in place environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of the cabinet. Evaporator coil is located on the interior rear wall of the cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior cabinet temperature of 33°F to 40°F (0°C to 4°C).

ACT control: ACT electronic, solid state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connections are 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15P plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable epoxy-coated wire shelf per door opening.

Drawers have 22-gauge stainless steel exterior with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Each top drawer will hold one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4"-6" (10.1cm-15.2cm) deep pans. Each bottom drawer holds one 12" x 20" (30.5cm x 50.8cm) pan and three 1/9 size 4" (10.1cm) deep pans. Pans are supplied by others.



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WELBILT®

John BOOS Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

102920

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PB-DISINK1014" PRO-BOWL DROP-IN HAND SINK

1 BOWL

FEATURES:

- ONE PIECE DEEP DRAWN BOWL
- ALL SINK BOWLS HAVE LARGE LIBERAL RADII CORNERS
- INCLUDES BASKET DRAIN
- DECK MOUNT FAUCET HOLES - 4" ON-CENTER

MATERIAL:

- BOWL: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH
- BRACKET: TYPE 300 STAINLESS STEEL POLISH, SATIN FINISH

CONSTRUCTION:

- BOWL: STAINLESS STEEL TOPS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE.



PB-DISINK101405



PB-DISINK101405-SSLR



PB-DISINK101405-P-SSLR



PB-DISINK101410



PB-DISINK101410-SSLR



PB-DISINK101410-P-SSLR

PRO-BOWL DROP-IN HAND SINKS

MODEL #	QTY
PB-DISINK101405	
PB-DISINK101405-SSLR	
PB-DISINK101405-P-SSLR	
PB-DISINK101410	
PB-DISINK101410-SSLR	
PB-DISINK101410-P-SSLR	

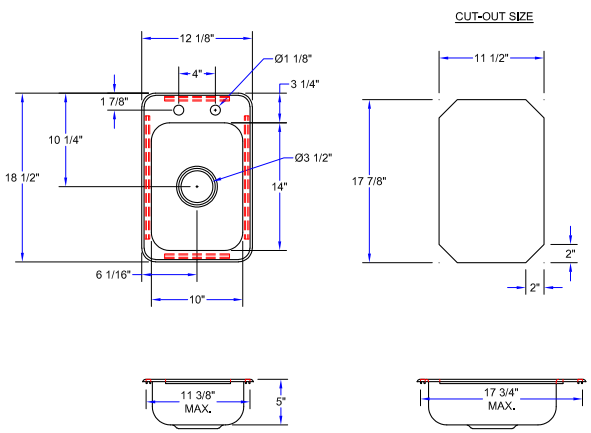
CALL FACTORY FOR CUT OUT SIZES.

OPTIONAL ACCESSORIES

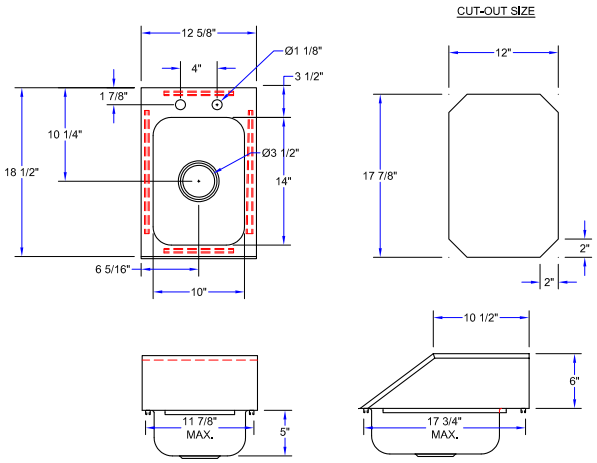
DESCRIPTION	QTY
FAUCETS	
SIDE SPASH	
ADA WRIST BLADES	
TOWEL DISPENSER	
LEVER WASTES	
OVER FLOWS	
P-TRAPS	

DETAILED SPECIFICATIONS

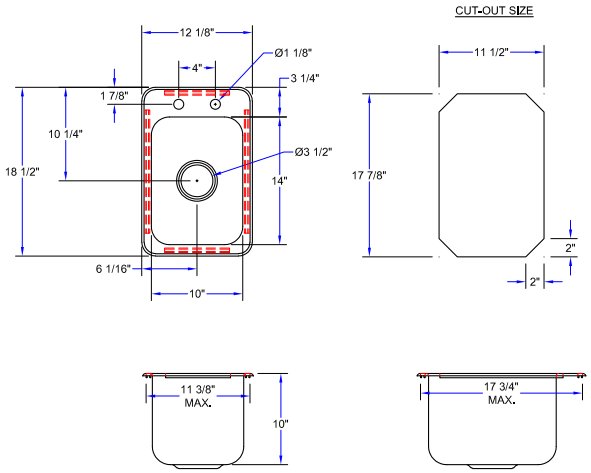
PB-DISINK101405



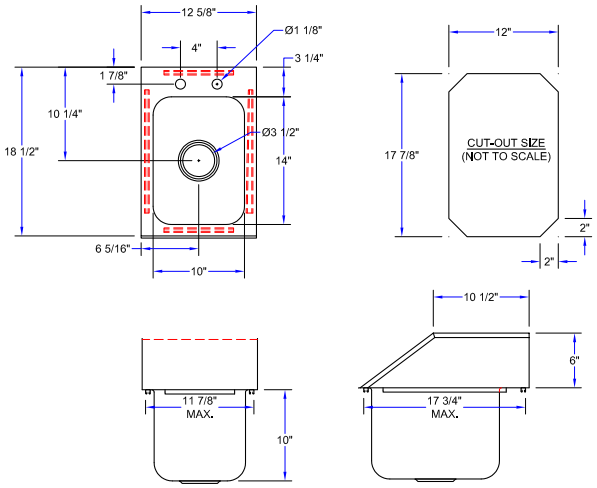
PB-DISINK101405-SSLR



PB-DISINK101410



PB-DISINK101410-SSLR



PRO-BOWL DROP-IN HAND SINKS

MODEL #	BOWL SIZE (LxWxD)	SINK SIZE (LxWxD)	CERTIFICATION	SIDE SPLASH
PB-DISINK101405	10" X 14" X 5"	12-1/4" X 18" X 5"	NSF COMPONENT, CSA	N/A
PB-DISINK101405-SSLR	10" X 14" X 5"	12-3/8" X 18-1/2" X 5"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101405-P-SSLR (INCLUDES: PBF-4-DLF)	10" X 14" X 5"	12-3/8" X 18-1/2" X 5"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101410	10" X 14" X 10"	12-1/4" X 18" X 10"	NSF COMPONENT, CSA	N/A
PB-DISINK101410-SSLR	10" X 14" X 10"	12-1/2" X 18-3/4" X 10"	NSF COMPONENT, CSA	LH & RH
PB-DISINK101410-P-SSLR (INCLUDES: PBF-4-DLF)	10" X 14" X 10"	12-1/2" X 18-3/4" X 10"	NSF COMPONENT, CSA	LH & RH

** SUGGESTED CUTOUT. VERIFY WITH PHYSICAL SINK DIMENSIONS FOR CUTOUT SIZE.
** WEIGHTS ARE SUBJECT TO ADDITIONAL PACKAGING

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.

APPLICATION:

PRODUCT NAME:

4" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

☐ 3515 W/ 12" SWIVEL GOOSENECK SPOUT

☐ 3525 W/ 6" SWIVEL GOOSENECK SPOUT

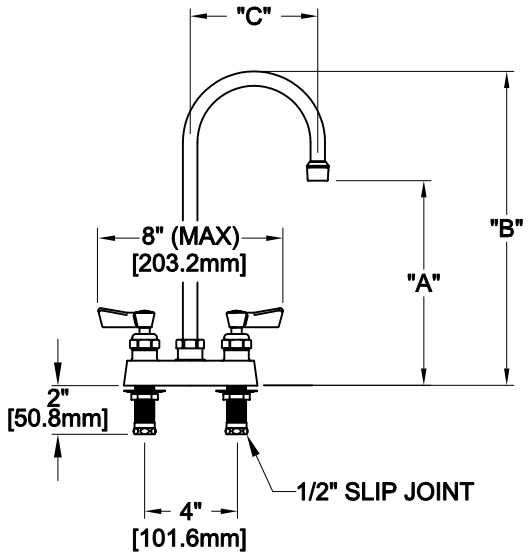
OPTIONS OR MODIFICATIONS:

☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH

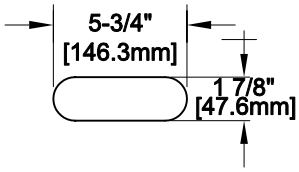
☐ VANDAL RESISTANT KIT

☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE

☐ OTHER _____

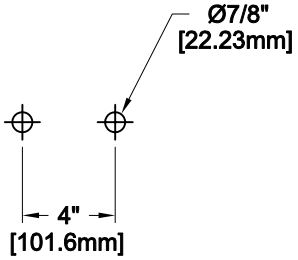


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3515	8-1/2" [215.9mm]	12-1/2" [317.5mm]	5-1/2" [139.7mm]
3525	4-3/4" [120.7mm]	8-3/8" [212.7mm]	3-1/2" [88.90mm]

ROUGH-IN:



FEATURES:

* 4" C/C DECK MOUNT
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT

SYSTEM LIMITS

* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 4.75 LBS

ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
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information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3515 REV. D

Jackson®
Warewashing Systems

Project _____
Item _____
Quantity _____
CSI Section 11400

DishStar® ADA-SEER

DishStar® ADA-SEER

High Temperature Sanitizing Undercounter with Steam Elimination & Energy Recovery



Standard Features

- ADA Compliant
- Fits easily beneath 34" countertops
- Steam Elimination
- Energy Recovery System collects the hot water vapor inside the machine and uses it to preheat the incoming rinse water
- Operates on a single cold water connection
- Soft Start helps protect glassware and dishes from chipping and breaking
- Energy Saver Mode
- Door interlock
- Pressure regulator and water hammer arrestor
- Recirculating wash design with fresh water rinse
- Built-in booster heater with Sani-Sure™ final rinse system ensures proper rinse temperature
- Solid-state controls with three selectable timed cycles for warewashing flexibility and performance
- Digital LED temperature/operator display
- Automatic tank fill with push button start
- Delime cycle
- Automatic pumped drain for floor and wall drain installations
- Built-in chemical pumps with automatic prime
- Stainless steel wash pump
- Above-water scrap basket
- Door switch
- Labyrinth-type door seal design
- Double-wall cabinet for quiet operation and heat retention
- Durable stainless steel construction
- One (1) each peg and combination rack included

Note:
A vent hood is not recommended above the Jackson DishStar ADA-SEER, as it does not produce excessive vapors. *Always check with the local building code to know what type of ventilation is required for commercial dishmachine installations in your area.*

Specification Statement

Specified unit will be an ADA-compliant Jackson DishStar ADA-SEER high temperature sanitizing door-type undercounter. Unit will be rated to NSF/ANSI Standard 3 by ETL Sanitation, will be ENERGY STAR® certified, and will operate on a single 3/4" cold water supply. Unit to include SEER, steam elimination and energy recovery. Unit to be rated for 24 racks per hour, 0.60 gallons per rack, and will include a 70 °F rise booster heater with Sani-Sure™ final rinse system, Energy Saver Mode, three (3) selectable timed cycles, and solid-state controls with digital LED temperature/operator display. Other features include Soft Start to protect glassware from chipping and breakage, built-in chemical pumps with automatic prime, automatic tank fill, above-water scrap basket, delime cycle, 3/4 HP stainless steel wash pump motor, pumped drain, pressure regulator, water hammer arrestor, door interlock switch, labyrinth-style door seal, and double-wall cabinet. Constructed of durable stainless steel.

1-year parts and labor warranty.

Options & Accessories

- Drain Water Tempering Kit
- Scale Prevention System (SPS)
- Replacement Cartridge for SPS
- Rear Dress Panel
- Tie Down
- Casters (set of four)
- 36-Compartment Rack
  4-1/8" tall (105 mm)
  5-5/8" tall (143 mm)
  7" tall (178 mm)
- Combination Rack
- Peg Rack

DishStar® ADA-SEER

Jackson Warewashing Systems

SEER

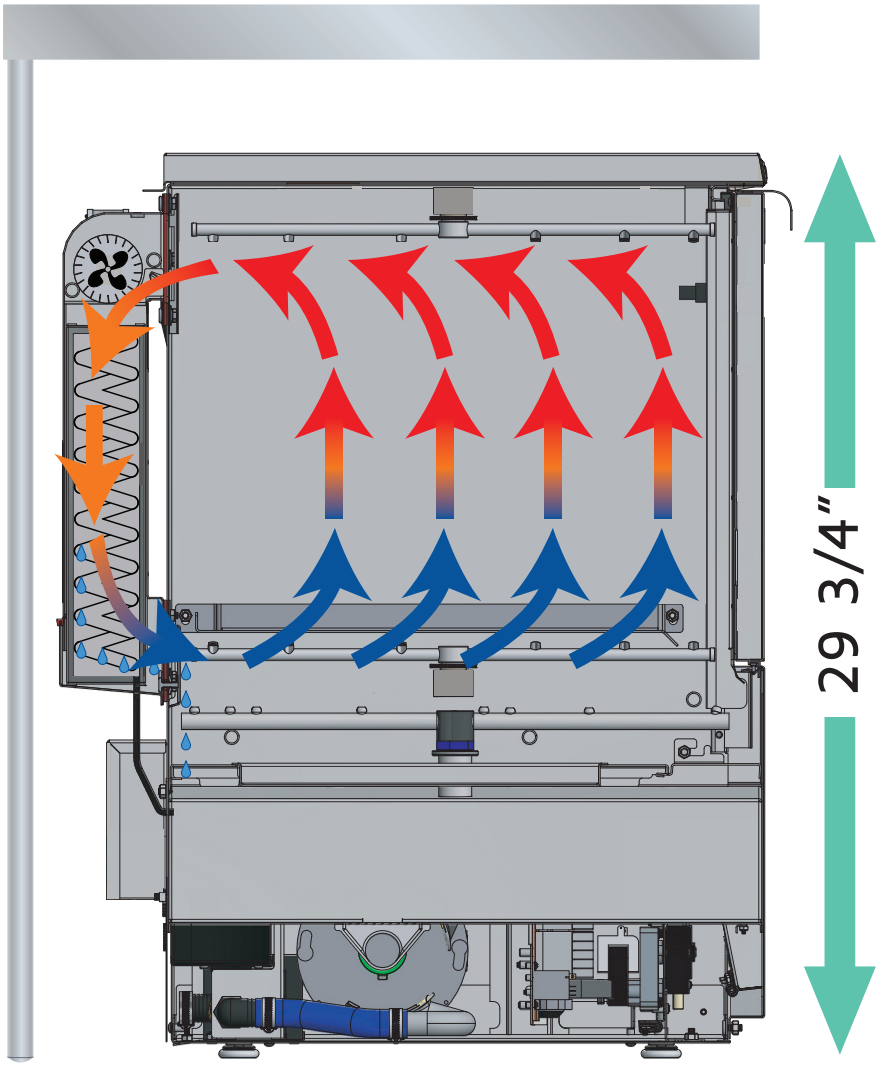
STEAM ELIMINATION AND ENERGY RECOVERY

Fan extracts the hot water vapor from the chamber

Vapor passing over the coils inside the Heat Exchanger provides a 40 °F rise in temperature to the water inside the coils

The cooler vapor returns back into the chamber, and as the vapor condenses it is channeled into the wash tank

This process virtually eliminates the steam inside the chamber



Cutaway side view of the DishStar® ADA-SEER

Jackson Warewashing Systems

DishStar® ADA-SEER

LEGEND

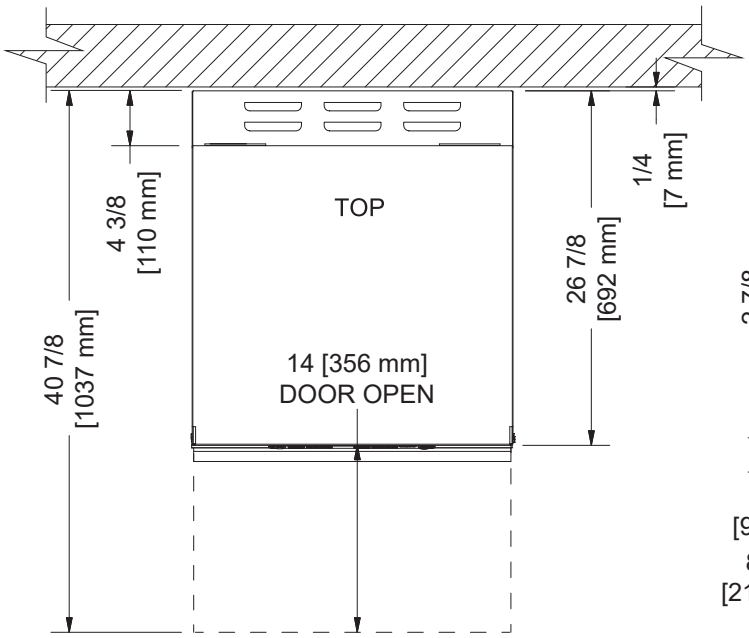
A - Electrical Connection

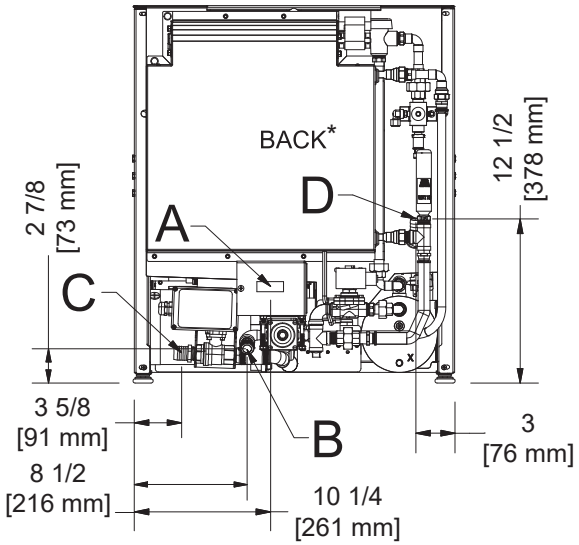
B - Water Inlet (with 5' Hose) (3/4" Male GHT, connect to true 1/2" ID line, 40–90 °F)

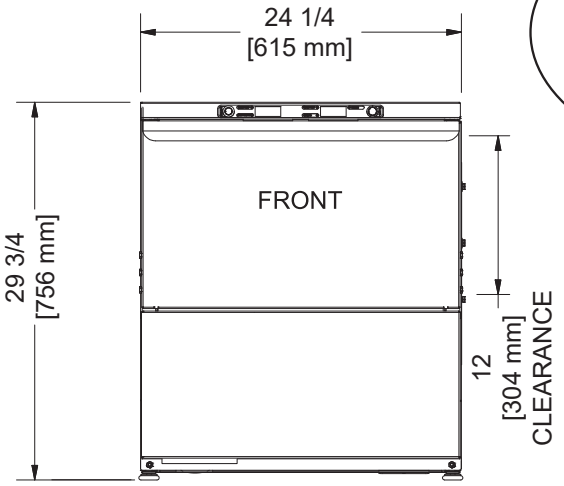
C - Drain Connection (5/8" ID, install into MIN 1 1/2" Drain with Air-gap)

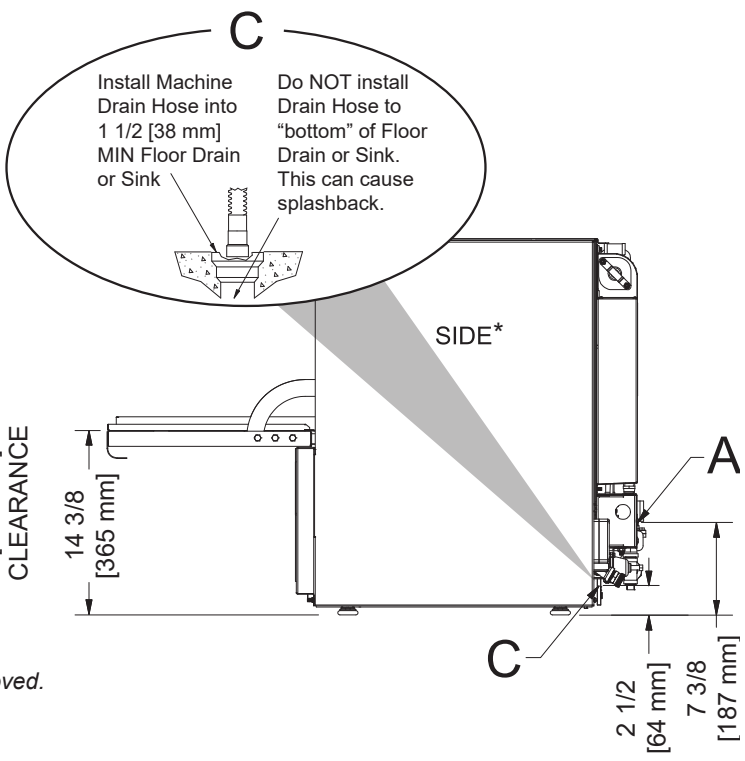
D - Chemical Port

All dimensions from the floor can be increased 1" using the machine's adjustable feet.









*Back and side views shown with back panel removed.

DishStar® ADA-SEER

Jackson Warewashing Systems

DishStar® ADA-SEER

High Temperature Sanitizing Undercounter with Steam Elimination & Energy Recovery

Operating Capacity (Cycle I)

Racks per Hour	24 (20)*
Dishes per Hour	600
Glasses per Hour	864

Operating Temperature

Wash Temperature (minimum)	155 °F/68 °C
Rinse Temperature (minimum)	180 °F/82 °C

Operating Cycle (seconds)

	Wash	Rinse	Dwell	Vent	Total Cycle
Cycle I	80	09	11	45	145
Cycle II	148	09	11	45	213
Cycle III	248	09	11	45	313

Water Consumption

Gallons per Rack	0.60 (2.3 L)
Gallons per Hour	14.4 (54.5 L)
Gallons per Hour**	12.0 (45.4 L)
Wash Tank Capacity (gallons)	3.0 (11.4 L)
Rinse Tank Capacity (gallons)	1.66 (6.3 L)

Water Requirements

Incoming Water Temperature	40-90 °F/5-33 °C
Flow Pressure (PSI)	10
Incoming Water Connection (NPT)	3/4" Male GHT (connect to true 1/2" ID line)
Drain Connection (ID)	5/8"

Electrical Specifications

Wash Pump Motor (HP)	
208v	3/4
230v	3/4
Wash Tank Heater (kW)	
208v	3.3
230v	4.0
Rinse Tank Heater (kW)	
208v	4.1
230v	5.2

Power Supply	Total Load	Minimum Circuit Ampacity	Maximum Overcurrent Protection
208/60/1	26.3 A	27.9 A	30.0 A
230/60/1	29.2 A	30.8 A	35.0 A

Dimensions

Width	24 1/4" (615 mm)
Depth	26 7/8" (692 mm)
Depth with Door Open	40 7/8" (1037 mm)
Height	29 3/4" (756 mm)
Inside Clearance Height	12" (304 mm)
Wall Clearance	1/4" (7 mm)
Drain Height	2 7/8" (73 mm)

Shipping Details

Shipping Weight	270 lbs (122 kg)
Shipping Width	28 1/2" (724 mm)
Shipping Depth	29 1/2" (749 mm)
Shipping Height	35 3/4" (908 mm)
Shipping Cube	17.39 cu ft
Shipping Class	85

**Racks per hour calculated with NSF suggested load time of :30 for front opening dishmachines.*

***Gallons per hour calculated with NSF suggested load time of :30 for front opening dishmachines.*

Contact Jackson

07610-004-96-60 [01/13/22]

Address
6209 N U.S. Highway 25E
Gray, Kentucky 40734

Telephone & Fax
T 888.800.5672
F 606.523.1799

Email
customer.service@jacksonwws.com

JACKSONWWS.COM JACKSON WAREWASHING SYSTEMS JACKSON WWS

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Delfield®

4448NP

Front-Breathing Self-Contained Flat Top Refrigerated Bases

Models

- 4448NP Single Section with Doors
- D4448NP Single Section with Drawers
- ST4448NP Single Section with Doors with Backsplash
- STD4448NP Single Section with Drawers with Backsplash



4448NP

Standard Features

- All 4400 Series units are 100% front breathing, which allows the unit to be pushed against a wall or built into a cabinet, or an existing lineup.
- Durable, rugged stainless-steel sides, top and front
- Features Delfield's exclusive ABS interior (on sides). ABS is extremely durable – it won't dent, chip or corrode and is backed by a limited lifetime warranty.
- "D" prefix models feature Delfield's new drawer system. Drawers are backed by a lifetime warranty on the track assembly.
- Bent in full length handle on doors and drawers.
- Standard on 5" casters for easy cleaning and installation
- One wire shelf standard, installed per door section.
- ACT solid state electronic control
- Environmentally friendly R290 refrigerant
- High density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane keeps energy costs low.
- 10' cord and plug supplied
- Three-year parts and labor warranty and a seven-year compressor parts warranty

Options & Accessories

- 18" wide single tier over shelf
- Stainless steel finish on back
- Cutting Boards
- Plastic laminate on front
- Additional wire shelves
- 3" casters, 4" ride height available
- Door lock
- Exterior thermometer (some models excluded)

Specifications

Exterior top is one-piece, 22-gauge stainless steel with integral 2.12" (5.4cm) square nosing on the front. ST and STD models have standard backsplash, full width and 4" (10cm) tall.

Exterior back and bottom are two-piece 24-gauge galvanized steel. Exterior ends are stainless steel. Interior sides are thermoformed ABS plastic with integral shelf supports. Base is fully insulated with high density foamed in place, environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane.

Refrigeration system uses environmentally friendly R290 refrigerant. Condenser coil and hot gas condensate evaporator mounted on rear of cabinet. Evaporator coil is located on the interior rear wall of cabinet. Refrigerant flow is controlled by a capillary tube. Cabinet maintains an interior temperature of 33°F to 41°F (0°C to 4°C).

ACT control: ACT electronic, solid-state control, mounted on the exterior rear of the cabinet, allows unit to maintain precise temperatures in heavy duty conditions.

Electrical connection is 115 volt, 60 Hertz, single phase. Unit has a 10' (3m) long electrical cord and NEMA 5-15 plug.

Casters: Equipment is mounted on 5" (13cm) diameter plate casters with front two locking brakes. Equipment clearance above the floor is 2.5" (6cm).

Doors have a 22-guage stainless steel exterior, with thermoformed ABS plastic interior liner. Cabinet has one adjustable wire shelf.

Drawers have a 22-gauge stainless steel exterior, with thermoformed ABS plastic interior liner. Drawer frames are 12-gauge stainless steel. Drawer slides are 11-gauge stainless steel with Delrin bearings. Top drawer holds one full size 12" x 20", 4"-6" (30.5cm x 50.8cm x 10.2cm) deep pan, and three 1/9 size pans. Bottom drawer holds one full size 12" x 20" and three 1/9 size, 4" deep pans. Pans are supplied by others.

ENERGY STAR
*Drawer models excluded

R290

4448NP Flat Top Refrigerated Bases

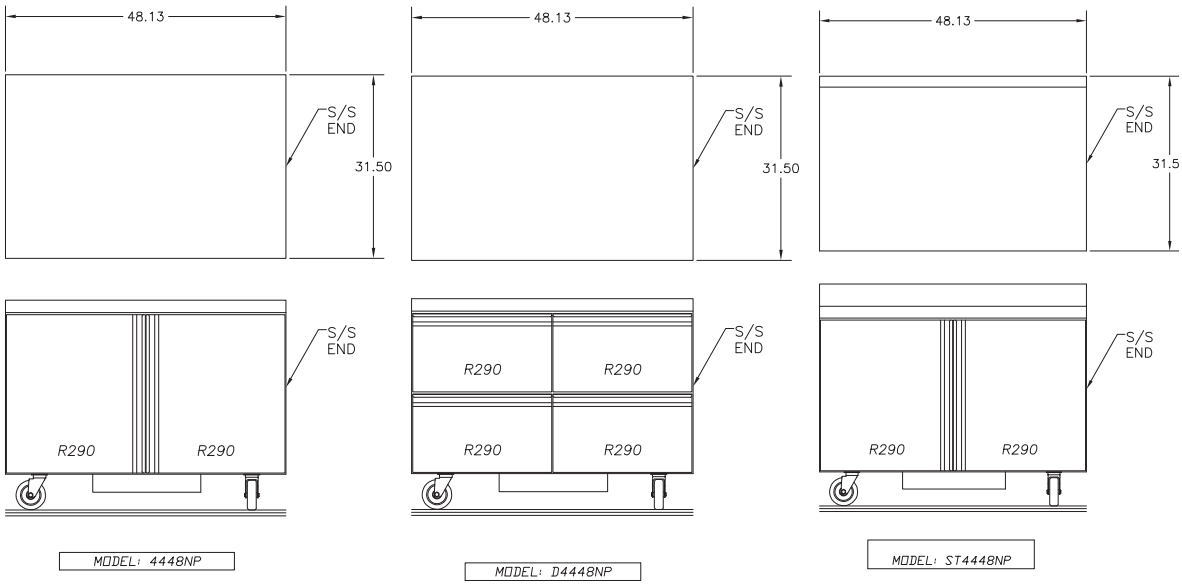
980 S. Isabella Rd.
Mt. Pleasant, Michigan 48858

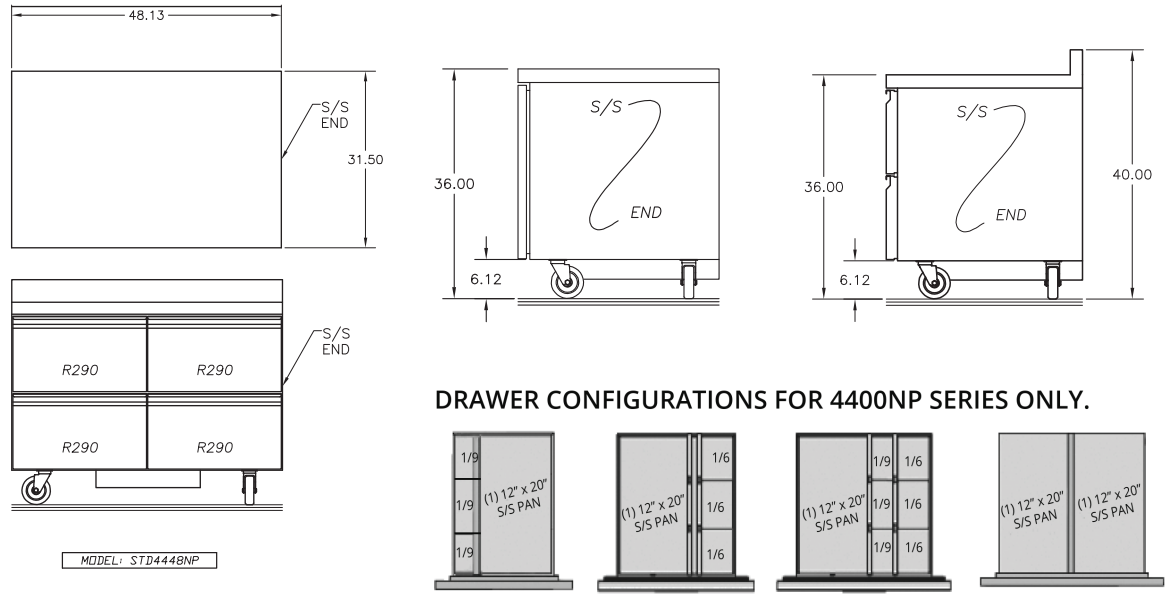
Phone: 800-733-8948 or 989-773-7981
Fax: 800-669-0619

www.delfield.com
4448ANP_Spec
02/24

Delfield®

4448NP Flat Top Refrigerated Bases





DRAWER CONFIGURATIONS FOR 4400NP SERIES ONLY.

Specifications

Model	# of Shelves	Shelf Area	Storage Volume	h.p.	V/Hz/Ph	Amps	Energy (kWh/day)	nema plug	Ship Weight
4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	1.01	5-15P	316lbs/143kg
D4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	N/A	5-15P	398lbs/181kg
ST4448NP	2	5.48ft²	14.23ft³	0.2	115/60/1	4.8	1.01	5-15P	316lbs/143kg
STD4448NP	N/A	N/A	14.23ft³	0.2	115/60/1	4.8	N/A	5-15P	398lbs/181kg

Welbilt reserves the right to make changes to the design or specifications without prior notice.

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ONE TANK SINKS – STAINLESS STEEL BOWL

MODELS TS Series	MODELS TSD Series
□ TS12HS	□ TSD12HS



Perlick Features

- Deep drawn stainless steel bowl
- NSF listed, commercial grade hot/cold water faucet (must be ordered separately)
- Underside is sound-deadened
- Stainless steel legs install without tools and have "Rust Free" thermoplastic feet

GENERATIONS OF EXCELLENCE

Form No. SK02
Rev. 09.19.2011

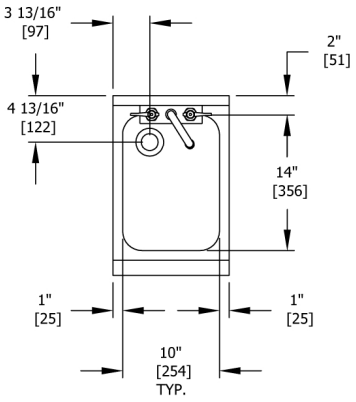
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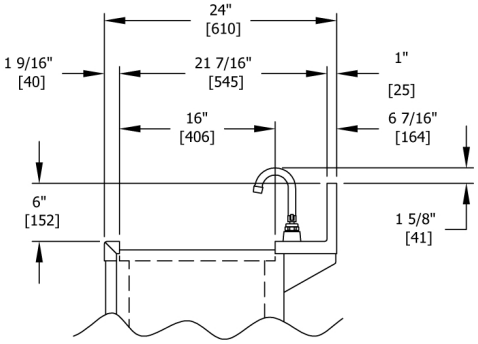
Size and Specifications

One Tank Sink – Stainless Steel Bowl

Job _____
Area _____
Item No. _____
Model No. _____

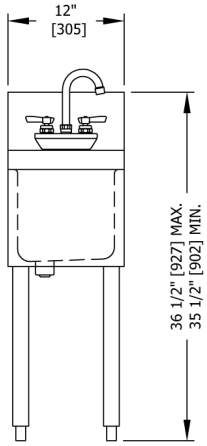
MODEL NO.	TS12HS	TSD12HS
LENGTH IN. (mm)	12" (305)	12" (305)
SHIP WEIGHT LB. (kg)	45 (20)	45 (20)
TOP & SIDES	Stainless steel	
BACK & BOTTOM	Stainless steel	
BACKSPLASH	Stainless steel 6" high (4" high optional) with 1" return at the top, mechanically fastened and sealed to hand sink top with steel support brackets. **TSD Series:** Stainless steel rear deck	
LEGS	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot.	
BOWL	Stainless steel with sound deadening. 10"x14"x9-1/4" deep. All horizontal and vertical edges 1-1/2" radius with balled corners. Furnished with 1-1/2" stainless steel drain socket. 8-1/2" standpipe.	
WATER FAUCET	Chrome plated, hot and cold, goose neck swing spout faucet. Heavy-duty all brass construction. ***Must be ordered separately.*** Lead free faucet also available.	
PLUMBING	Drain connection: 1-1/2" NPS male. Hot and cold water connection, 3/8" copper supply tubes	Drain connection: 1-1/2" NPS male. Hot and cold water connection, 1/2" IPS shanks and nuts

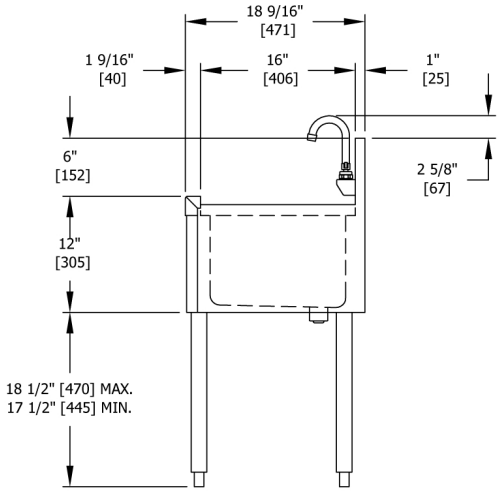




TSD END VIEW

**Faucet shown for clarity;*
must be ordered separately





Form No. SK02
Rev. 09.19.2011

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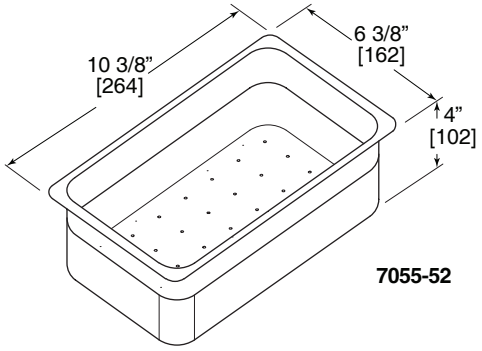
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UNDERBAR ACCESSORIES
BLENDERS AND SINKS

Job _____
Area _____
Item No. _____
Model No. _____

WET WASTE BOX- PERFORATED

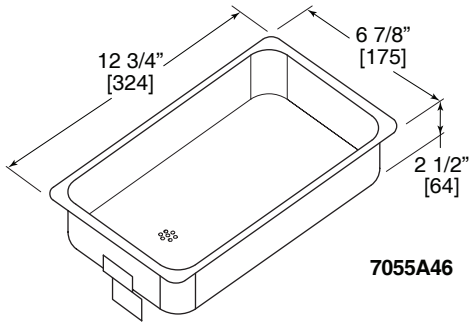
PART NO.	7055-52
APPLICATION	Perforated pan allows liquid to drain from wet waste into 12” and 14” stainless steel Blender Station bowls. Not applicable on full size stainless steel sinks.
MATERIAL	¼ size clear polycarbonate pan (2.7 quart) with 1/8” diameter holes in bottom.



7055-52

WET WASTE BOX- WITH DRAIN TUBE

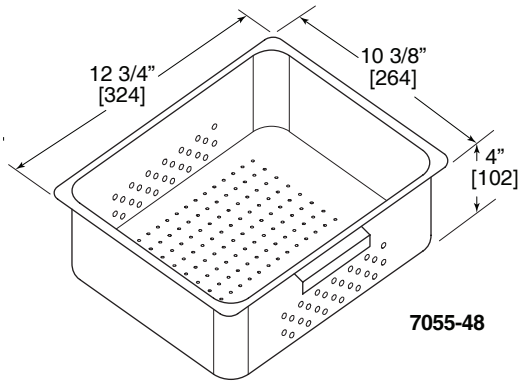
PART NO.	7055A46
APPLICATION	TS Series: Drains into standpipe on three and four tank sinks. **NOTE**: Use on sinks bowls without faucet (faucet body interferes with Wet Waste Box). TSD Series: Drains into standpipe on one, two, three and four tank sinks.
MATERIAL	1/3 size stainless steel pan (2.25 quart) with integral strainer and ¾” diameter x 2 3/8” long drain tube.



7055A46

WET WASTE BOX- PERFORATED

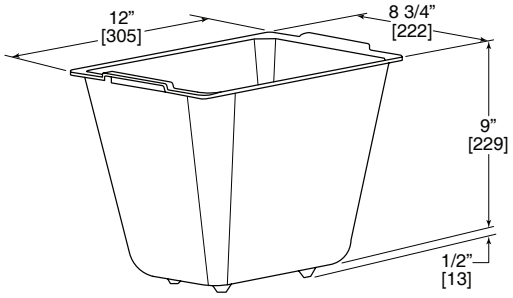
PART NO.	7055-48
APPLICATION	Perforated pan allows liquid to drain from wet waste into any sink with full size stainless steel bowl. Not applicable on 12” and 14” blenders.
MATERIAL	½ size stainless steel pan (7 quart) with 1/8” diameter holes in bottom and ¼” diameter holes on two sides.



7055-48

WET WASTE BOX - PERFORATED (UNIVERSAL)

PART NO.	UAC - WWB
APPLICATION	Perforated pan allows liquid to drain from wet waste into any sink with full size stainless steel bowl. Not applicable on 12” and 14” blenders.
MATERIAL	Black ABS (11 quart) with 3/16” diameter holes in bottom.



UAC-WWB

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UNDERBAR ACCESSORIES
BLENDERS AND SINKS

Job _____
Area _____
Item No. _____
Model No. _____

ELECTRONIC "TOUCH-FREE" FAUCET ADAPTER

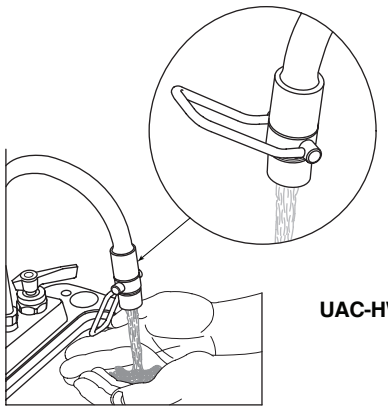
PART NO.	UAC-EFA
APPLICATION	Converts most faucets into an automatic "Touch-Free" faucet. Simply remove the faucet aerator and install the adapter to end of spout with a simple screw-on installation.
FLOW RATE	2.2 GPM Aerator. Infrared sensor stops water flow automatically. 3-minute automatic time-out feature minimizes chance of overflow. Manual on/off over-ride button provides constant flow to fill sink or containers.
WATER TEMP.	Manually set the faucet handles to desired temperature.
POWER SUPPLY	(4) AAA Batteries (not included). Low battery indicator.
SENSOR RANGE	2"- 10" (5- 25cm) based on sink type and illumination.
WORKING PRESSURE	10-125 psi



UAC-EFA

AUTOMATIC FAUCET CONTROLLER

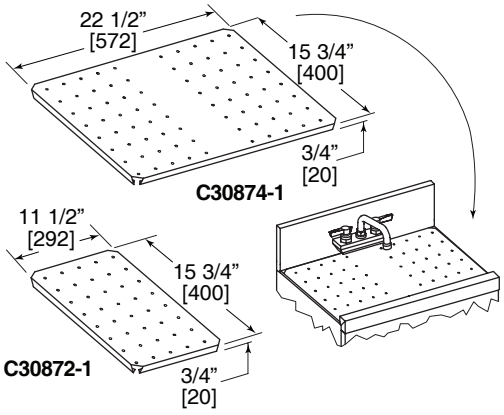
PART NO.	UAC-HWFC
APPLICATION	Converts any faucet to "Hands-Free". Simply remove the faucet aerator and install controller to end of spout (supplied with universal adapters).
FLOW RATE WATER TEMP	Manually set the faucet handles to desired water flow and temperature.
MATERIALS	Brass and stainless steel with an anti-microbial coated lever
OPERATION	Automatic self-closing "Hands-Free" full on position



UAC-HWFC

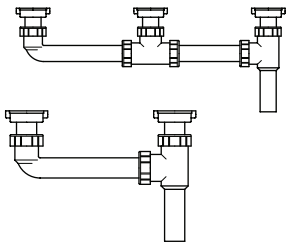
PERFORATED COVER-STAINLESS STEEL

APPLICATION	PART NO.
Converts complete bowl opening on TS12HS to a Drainboard.	C30872-1
Converts complete two bowl opening on TS22C to a Drainboard.	C30874-1



DRAİN ASSEMBLES-PVC

APPLICATION	PART NO.
Sinks with two stainless steel bowls (ex.TS22C)	202PVC
Sinks with three stainless steel bowls (ex. TS33C)	26482PVC
Sinks with four stainless steel bowls (ex. TS44C)	26843PVC



26482PVC

202PVC

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Form No. ACC-02
Rev. 04.23.10

MOYER DIEBEL®
Simply Engineered Better

Project _____
Item No. _____
Quantity _____

DF

Rotary Type Fully Automati
Glasswashing Machine



(Optional DF71 drain tray and waste collector is available but not shown)

STANDARD FEATURES

- 12" glass clearance accepts taller stemware
- Internal upper drain screen for improved filtration and ease of cleaning
- Self flushing rinse chamber reduces maintenance
- Reduced water usage
- Improved shut off mechanism
- Three-pump injection system for precise chemical dispensing
- Upper and lower wash and rinse arms produce sparkling clean glasses every time
- Double walled construction for quieter operation
- Cool final rinse water provides a cool glass ready for immediate use
- An internal shelf provides storage for three, 1-gallon (4 liter) containers
- Polypropylene conveyor eliminates chipping of fine stemware
- Internal rinse water tempering valve

SPECIFIER STATEMENT

Specified unit will be Moyer Diebel model DF Rotary Type, fully automatic glasswasher.

Unit will have detergent pump, sanitizer pump and rinse aid pump, standard upper and lower wash/rinse arms, wash tank heater, cold water final rinse, polypropylene conveyor, splash curtain, double-walled construction, storage space for three 1-gallon containers.

OPTIONS & ACCESSORIES

☐ Drain tray and waste collector (DF-71)	P/N 0712551
☐ Quick disconnect package (incl. casters)	P/N 0707258
☐ Casters; set of four – 2 locking, 2 regular	P/N 0701962
☐ Hand sink and wet waste receiver (SW46)	P/N 0708453
☐ Wash down hose	P/N 0701956
☐ Site Glass kit	P/N 0712993

MD005 Printed in USA

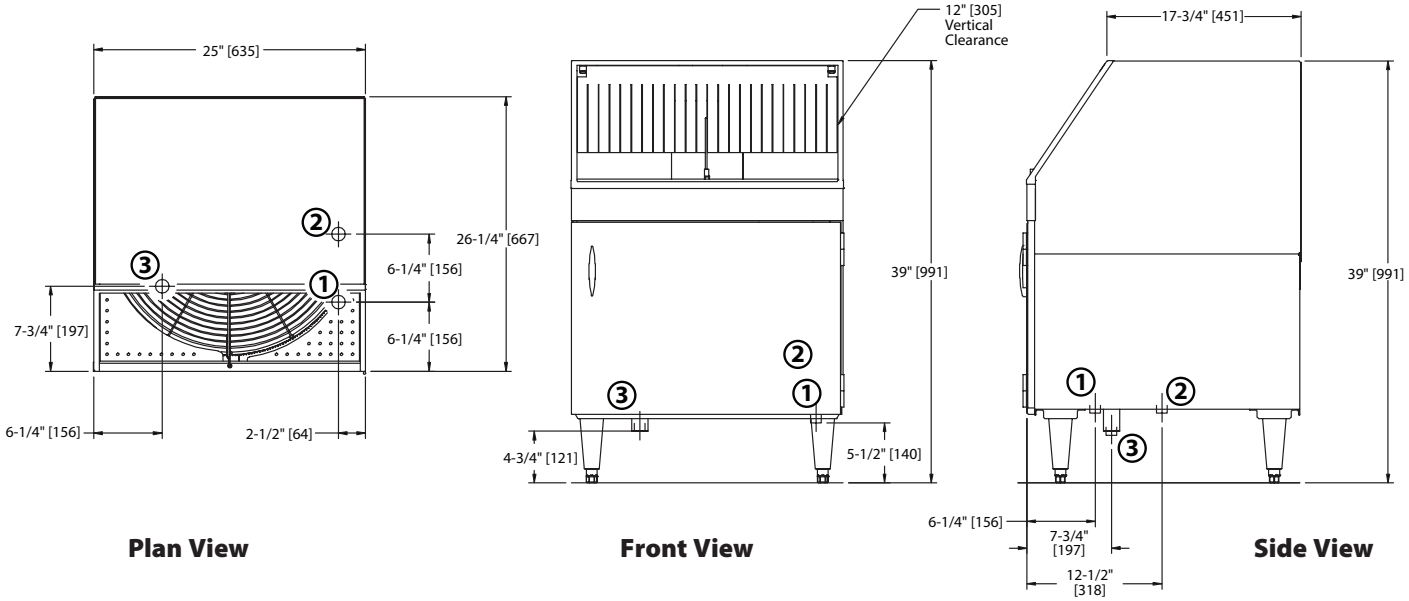
Moyer Diebel – USA
3765 Champion Blvd, Winston-Salem, NC 27105 Tel: 336/661-1992 Fax: 336/661-1979 800/228-8350
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MOYER DIEBEL®
Simply Engineered Better

DF

Rotary Type Fully Automatic
Glasswashing Machine

Dimensions shown in inches and [millimeters]



Plan View **Front View** **Side View**

UTILITIES

	Electrical 208 - 230/60/1, 15 amp
1	**Hot water connection** 1/2" [13] IPS. Flow pressure 25-95 psi [172.5-656 kPa]
2	**Cold water connection** 1/2" [13] IPS. Flow pressure 25-95 psi [172.5-656 kPa]
3	**Drain connection** 1-1/2" [38] tailpiece. Connect to drain size according to local plumbing code.

	Uncrated	Crated
Height	39" [991]	46-1/2" [1181]
Width	25" [635]	27" [685]
Depth	27" [686]	27-1/2" [698]
Ship Wt. lbs/kg	156/71	176/80

* Adjustable foot height - 11/4" [45]

NOTE: DF Models supplied with 6 ft. [1829] plug in cord. (NEMA 6-15P)

Warning: Plumbing and electrical connections must be made by qualified personnel who will observe all the applicable plumbing, sanitary and safety codes.

Due to an ongoing value analysis program at Moyer Diebel, specifications in this catalog are subject to change without notice.

SPECIFICATIONS

Capacity (hr.)
2-1/2" [64] glasses 1200

Water Consumption
Cold water (approx.) 2.5 US gpm; 9.5 l/m; 2.1 imp. gpm
Hot water (initial fill) 3 US gallons; 11.35 liters; 2.4 imp gallons
(Max use – approx. 12 US gph – 10 imp gph)

Temperatures °F/C
Inlet water (hot) 140-160/61-69
Inlet water (cold) 75/24

Heating
Tank heat, electric (kW) 3

Conveyor Movement Clockwise

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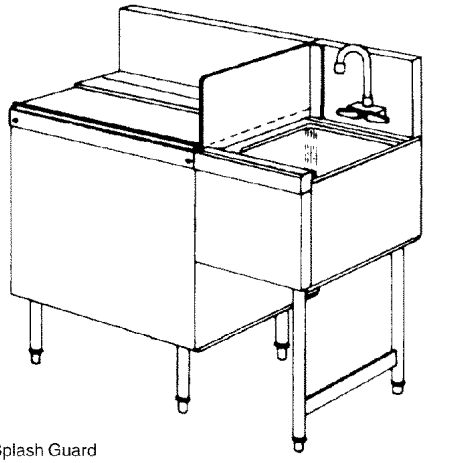
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Splashguards

Stainless steel. Factory installed between individual Topshelf modules or added to either end.

Part No.	For Model No.	Length	Height
7054L	Left endsplash for TS series	18"	8"
7054R	Right endsplash for TS series	18"	8"
7054	Between modules for TS series	18⅝"	8"
7054DL	Left endsplash for TSD series	24"	8"
7054DR	Right endsplash for TSD series	24"	8"
7054D	Between modules for TS series	24⅝"	8"
7054SL	Left endsplash for TSs series	38"	8"
7054SR	Right endsplash for TSS series	38"	8"

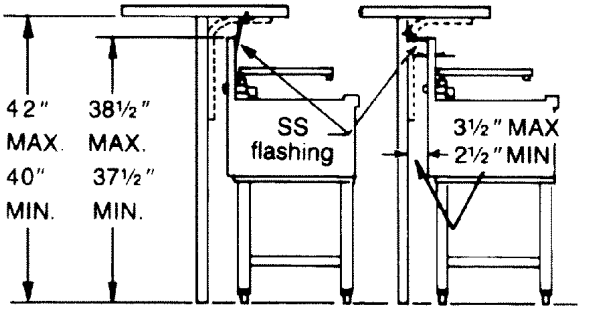


No. 7054 Splash Guard between two workboard modules

STAINLESS STEEL UNDERBAR FLASHING

Used to seal underbar service area to underside of bar. Also used to bridge the gap between the bar die and backsplash or the underbar and backsplash. Available in ten foot lengths which are easily formed in the field to match the bar die. Predrilled holes to facilitate installation.

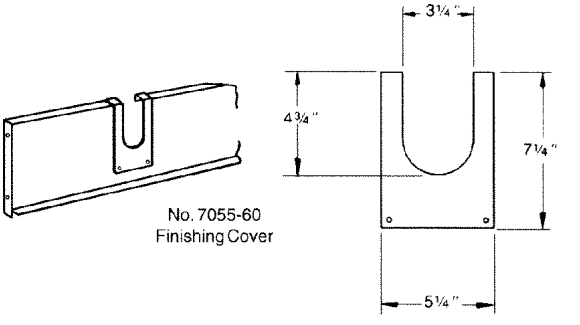
Part No.	Description
C31682	First ten feet - 4½" wide
C31683	Additional ten foot lengths - 4½" wide



No. C31682
Stainless Steel Flashing

ACCESS CUTOUT FINISHING COVER for Trunk Housing

Part No.	Description
7055-60	Finishing cover



No. 7055-60
Finishing Cover

CONNECTOR KITS

One required for each joint.

Part No.	Description
7055-45*	For modules with 8" backsplash
7055-4-45*	For modules with 4" backsplash
7055-53	For end mount in lieu of leg

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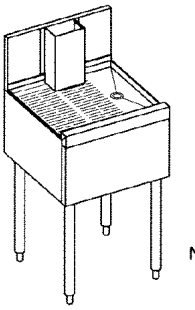
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Access Cutout with Chase for TS Series Drainboards

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-69	For 8" backsplash	3"	5"
7055-69-4	For 4" backsplash	3"	5"



Drainboard with No. 7055-69 Cutout

Backsplash Cutout for Soda Lines

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-265	Backsplash cutout for soda lines	6"	4"

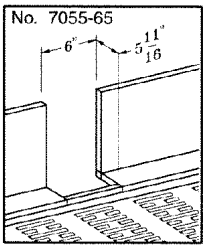
ACCESS CUTOUT FINISHING COVER for Trunk Housing

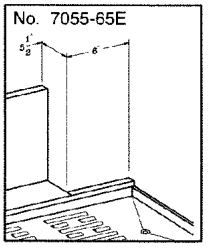
Part No.	Description
7055-60	Finishing cover

ACCESS CUTOUT without Chase for TSD Series Workboards

Provides a 6" x 5¾" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-65E	Cutout at either end (specify location)
7055-65	Cutout 6" increments from either end (specify location)

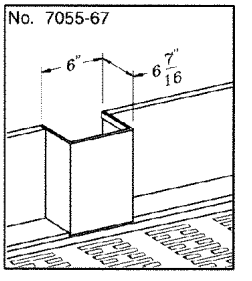


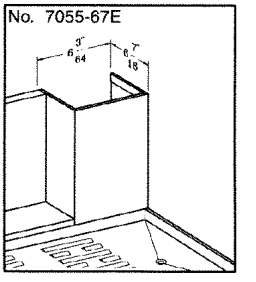


ACCESS CUTOUT with Chase for TSD Series Workboards

Provides a 6" x 6½" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-67E	Cutout at either end (specify location)
7055-67	Cutout 6" increments from either end (specify location)





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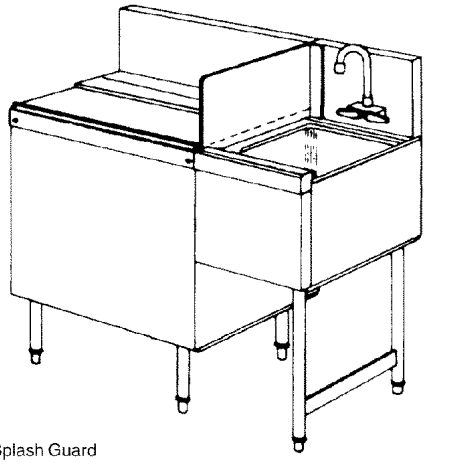
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Splashguards

Stainless steel. Factory installed between individual Topshelf modules or added to either end.

Part No.	For Model No.	Length	Height
7054L	Left endsplash for TS series	18"	8"
7054R	Right endsplash for TS series	18"	8"
7054	Between modules for TS series	18⅝"	8"
7054DL	Left endsplash for TSD series	24"	8"
7054DR	Right endsplash for TSD series	24"	8"
7054D	Between modules for TS series	24⅝"	8"
7054SL	Left endsplash for TSs series	38"	8"
7054SR	Right endsplash for TSS series	38"	8"

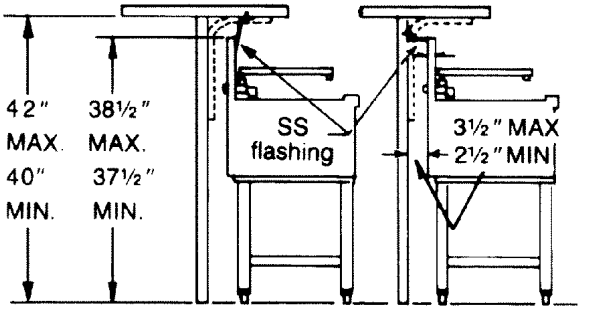


No. 7054 Splash Guard between two workboard modules

STAINLESS STEEL UNDERBAR FLASHING

Used to seal underbar service area to underside of bar. Also used to bridge the gap between the bar die and backsplash or the underbar and backsplash. Available in ten foot lengths which are easily formed in the field to match the bar die. Predrilled holes to facilitate installation.

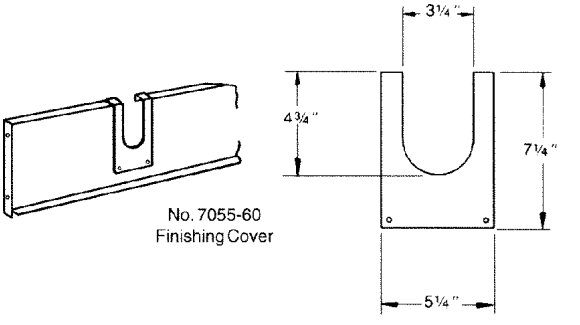
Part No.	Description
C31682	First ten feet - 4½" wide
C31683	Additional ten foot lengths - 4½" wide



No. C31682
Stainless Steel Flashing

ACCESS CUTOUT FINISHING COVER for Trunk Housing

Part No.	Description
7055-60	Finishing cover



No. 7055-60
Finishing Cover

CONNECTOR KITS

One required for each joint.

Part No.	Description
7055-45*	For modules with 8" backsplash
7055-4-45*	For modules with 4" backsplash
7055-53	For end mount in lieu of leg

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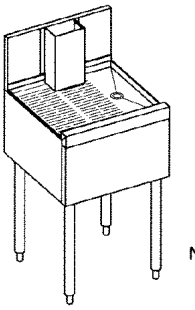
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Access Cutout with Chase for TS Series Drainboards

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-69	For 8" backsplash	3"	5"
7055-69-4	For 4" backsplash	3"	5"



Drainboard with No. 7055-69 Cutout

Backsplash Cutout for Soda Lines

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-265	Backsplash cutout for soda lines	6"	4"

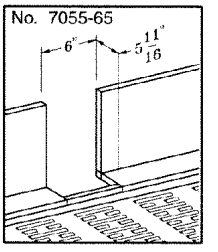
ACCESS CUTOUT FINISHING COVER for Trunk Housing

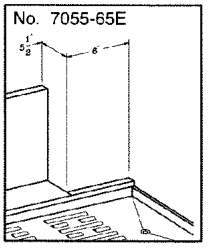
Part No.	Description
7055-60	Finishing cover

ACCESS CUTOUT without Chase for TSD Series Workboards

Provides a 6" x 5¾" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-65E	Cutout at either end (specify location)
7055-65	Cutout 6" increments from either end (specify location)

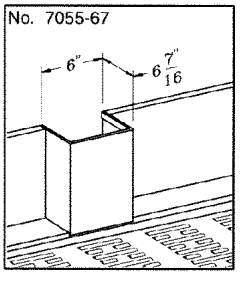


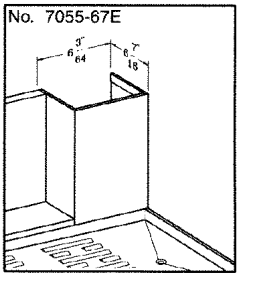


ACCESS CUTOUT with Chase for TSD Series Workboards

Provides a 6" x 6½" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-67E	Cutout at either end (specify location)
7055-67	Cutout 6" increments from either end (specify location)





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TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS12DB



TS30DB

MODELS
TS12DB
TS18DB
TS24DB
TS30DB
TS36DB
TS42DB
TS48DB

Other sizes available in 1" increments from 12" up to 30".

KEY PRODUCT FEATURES AND BENEFITS

- Drainboard tops are pitched to the drain, so water is evacuated quickly and effectively. With the matching insert, you still get a flat, level space to store your glassware.
- The default option of 'stadium' shaped perforated inserts enable great air flow for efficient glassware drying, maximize glass storage, and are designed to hold up to a busy bar environment abuse.
- Our new, more robust Perlick Quick Clamp leg attachment still features easy tool-less installation.
- All stainless construction with 18 gauge seamless stainless steel front apron for durability and cleanability.
- All Perlick drainboards are NSF-certified, so you can feel confident knowing your equipment will meet health code standards.

Additional Features:

- Optional Perlick Flex Mount leg relocation kit moves rear legs forward for additional space behind the equipment or moves forward legs rearward to help avoid pesky floor drains, available on TSF units.
- Swap out the perforated insert for a flat top insert when needs change and want to use the drainboard as a workspace Available on 12", 18", 24", 30".
- Stainless steel legs with adjustable thermoplastic feet install without tools for freestanding applications.

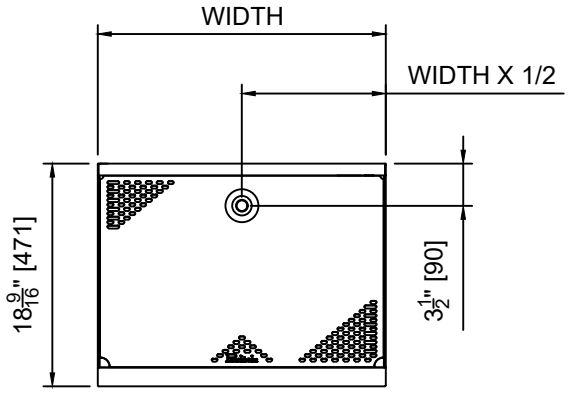
Form No. Z2958
Rev 11.29.23

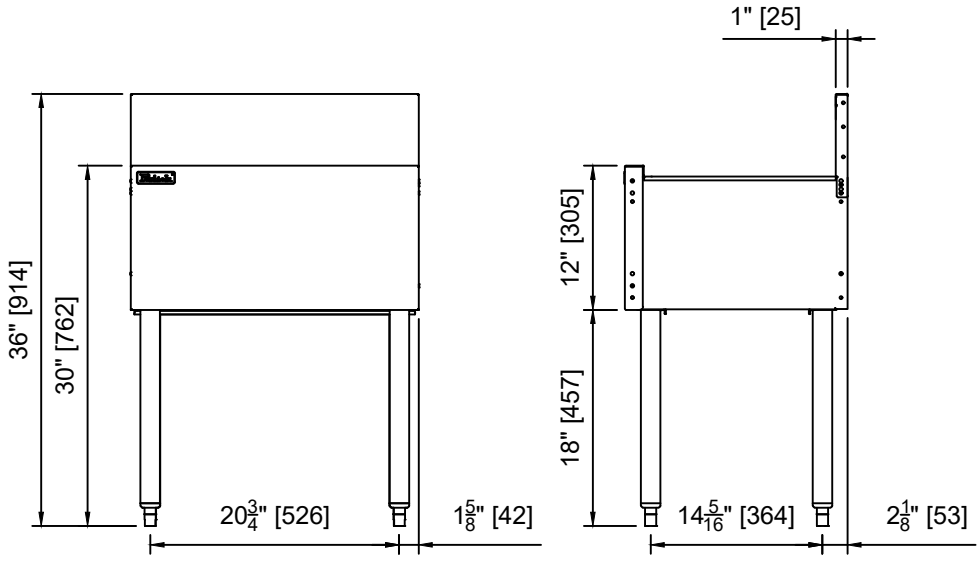
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TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

MODEL NOS.		TS12DB	TS18DB	TS24DB	TS30DB	TS36DB	TS42DB	TS48DB
DIMENSIONS: EXTERIOR	Width In. (mm)	12" (305)	18" (457)	24" (610)	30" (914)	36" (914)	42" (1067)	48" (1219)
	Depth In. (mm)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)
	Weight lb. (kg)	35 (16)	40 (18)	45 (20)	50 (23)	60 (27)	90 (41)	115 (52)
MATERIALS	Construction	All stainless steel						
	Front & Back	Seamless 18 gauge stainless steel						
	Backsplash	6" or 4" high stainless steel with 1" return, fastened and sealed.						
	Drainboard	Pitched stainless steel drainboard top, All horizontal and vertical edges 1/4" radius with balled corners.						
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot						
MECHANICALS	Plumbing	Stainless steel drain socket located back center of the equipment. Drain connection is 1-1/2" NPS male.						
OPTIONAL ACCESSORIES (PARTIAL LIST)		Perforated insert(s), flat top insert(s), speed rails, bottle opener, end splashes, backsplash cutout						

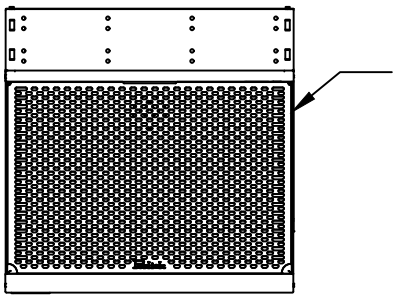




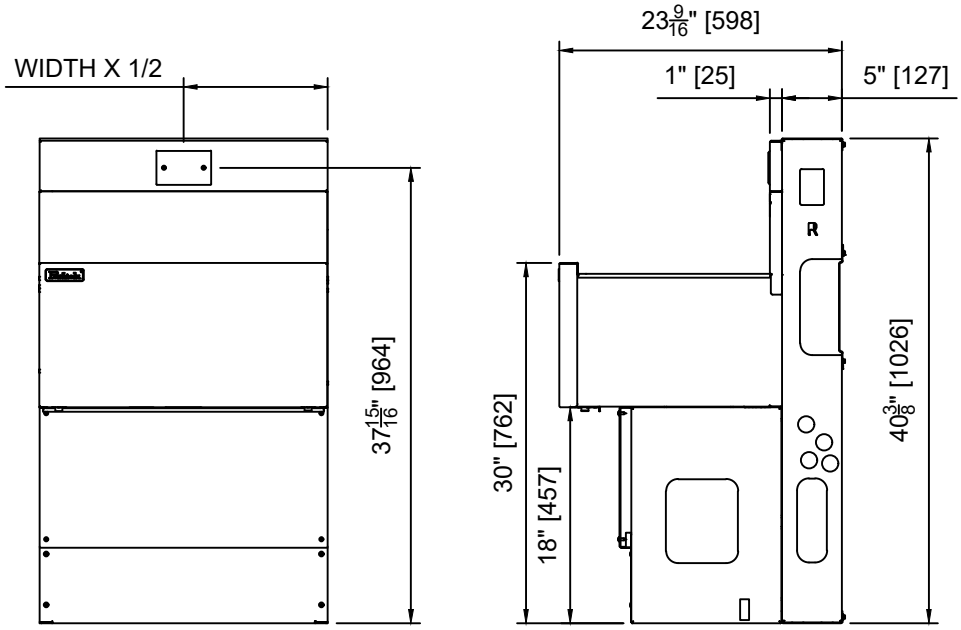
Form No. Z2958
Rev 11.29.23

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

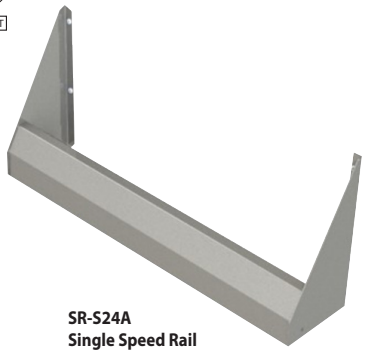


SHOWN WITH FULL
DRAINBOARD INSERT

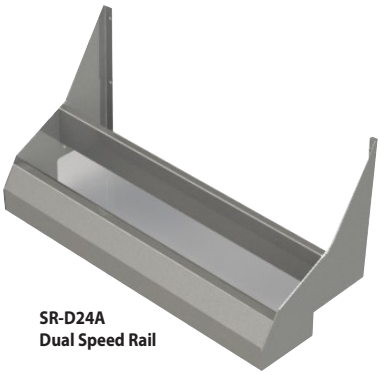


SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

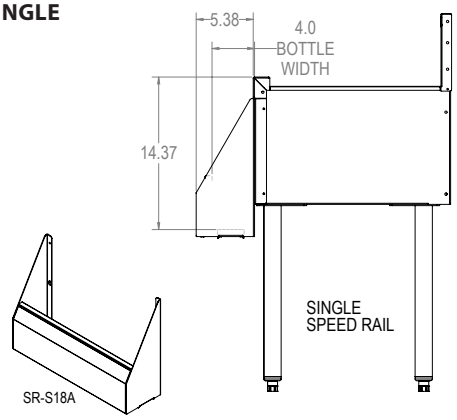
Form No. Z2462
Rev. 01.24.22

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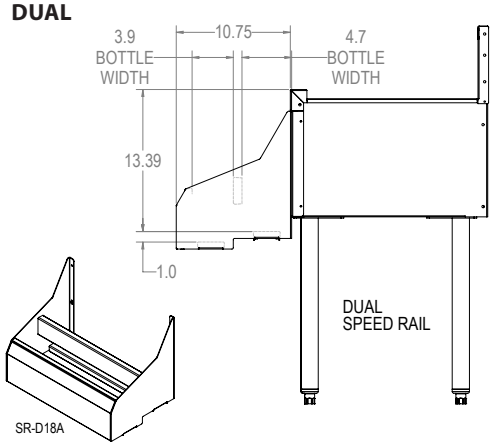
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

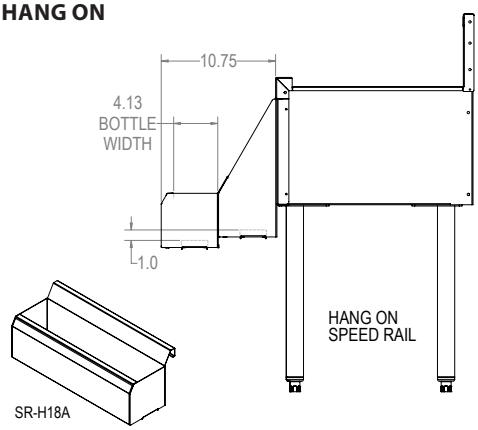
SINGLE



DUAL



HANG ON

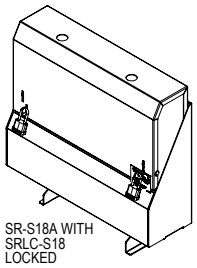


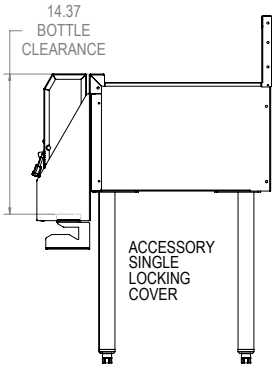
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

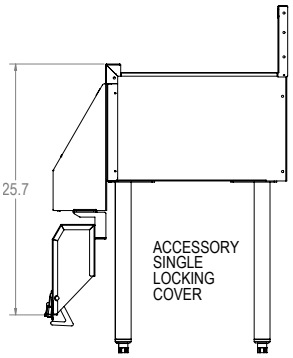
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

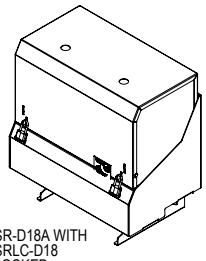


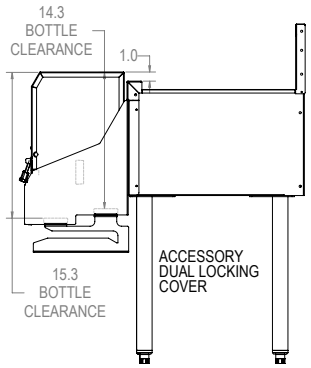


Single cover stored when not in use.

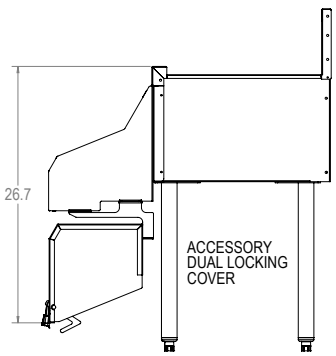


DUAL LOCKING COVERS





Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

UNDERBAR ICE CHESTS

TS Series Ice Chests

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS24IC10

MODELS	
Cold Plate	**Non-Cold Plate**
	TS18IC
TS24IC10	TS24IC
TS30IC10	TS30IC
TS36IC10	TS36IC
TS42IC10	TS42IC
TS48IC10	TS48IC

KEY PRODUCT FEATURES AND BENEFITS

- All stainless for durable easy to clean surfaces
- Fully insulated to reduce ice melt in warm climates
- Highly efficient cold plates instantly chill your soft drinks to the correct temperature
- Eco-friendly foam insulation is efficient and has zero impact on global warming or ozone depletion
- Stainless steel legs with adjustable thermoplastic feet are strong and install easily without tools
- Available with or without a cold plate to suit your bartender's needs

Quick Features:

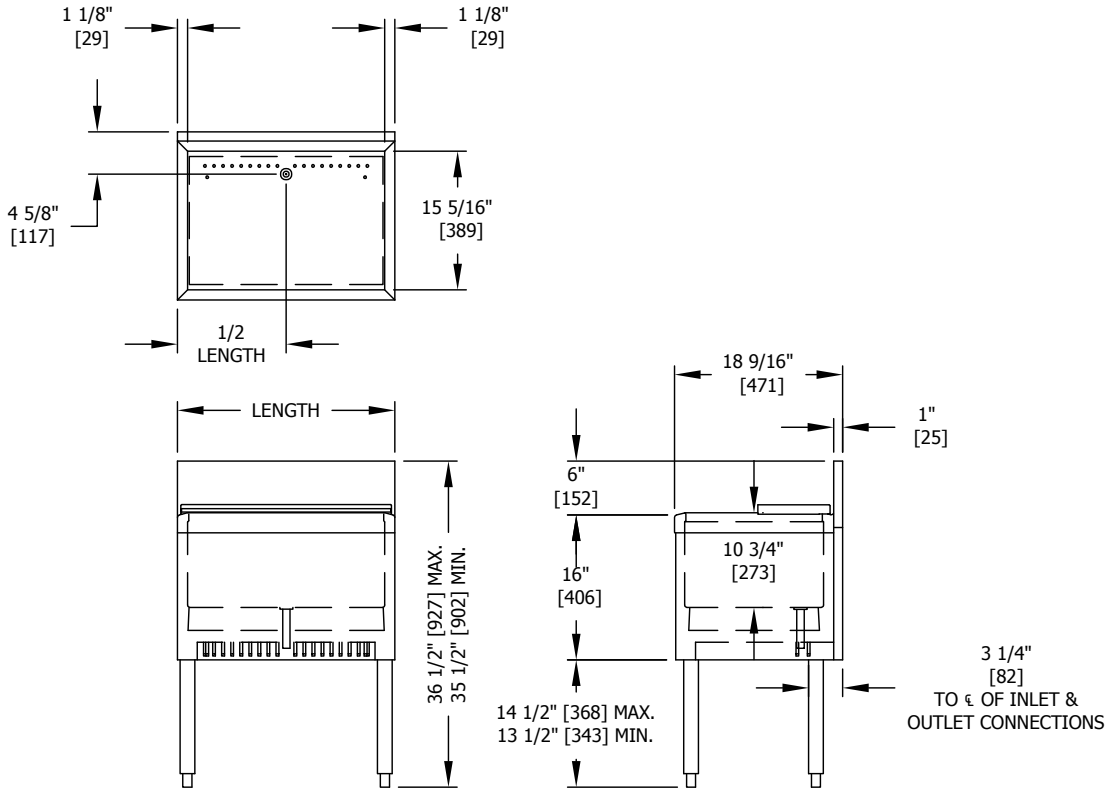
- Fully insulated with highly efficient eco-friendly polyurethane foam
- Built with stainless steel to maximize the lifespan
- Boldly innovative cold plate design increases thermo efficiency to instantly chill your soft drink to the right temperature

UNDERBAR ICE CHESTS

TS Series Ice Chests

MODEL NOS.							
MODEL TYPE:	Non-Cold Plate Models	**TS18IC**	**TS24IC**	**TS30IC**	**TS36IC**	**TS42IC**	**TS48IC**
	Cold Plate Models	**NA**	**TS24IC10**	**TS30IC10**	**TS36IC10**	**TS42IC10**	**TS48IC10**
DIMENSIONS: EXTERIOR (mm)	Length, Inches (mm)	18 (457)	24 (610)	30 (762)	36 (914)	42 (1067)	48 (1219)
	Ice Capacity, lbs. (kg)	60 (27.2)	80 (36.3)	100 (45.4)	125 (56.7)	145 (65.8)	165 (74.8)
	Ship Weight with cold plate lb/kg	NA	81 (36.5)	86 (39)	92 (41.5)	98 (44.4)	103 (46.7)
	Ship Weight without cold plate lb/kg	28 (12.7)	34 (15.3)	38 (17.2)	45 (20.3)	50 (22.7)	55 (25.1)
MATERIALS	Front & Sides	Stainless Steel					
	Backsplash	Stainless steel, 6" high, (4" optional), with 1" return at top, mechanically fastened and sealed to ice chest top with steel support brackets					
	Back & Bottom	Galvanized steel					
	Interior	Stainless steel with 1/4" Radius corners, welded, polished, and sealed with non-exposed cold plate. Interiors can be divided with accessory freestanding ice bin dividers.					
	Insulation	Eco-friendly foamed-in-place polyurethane					
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot					
	Top Rim	ABS					
MECHANICALS	Plumbing	Drain connection– 1-1/2" NPS male					
	Cold Plate	Cast aluminum plate concealed under ice chest liner. Cold plate has 2 full-length circuits and 8 half length circuits. **Connections** – 5/16" O.D. stainless steel tubing with swaged end to accept standard 1/4" I.D. beverage tubing					
OPERATING SPECIFICATIONS	Cold Plate	Each full circuit will deliver four 6 oz. drinks per minute at 40° continuously, or 40 oz. every three minutes in a single draw (flow rate 2 oz./sec, 75° product)					
MISCELLANEOUS	Accessories *(Ordered separately)*	Covers, ice bin dividers, condiment trays with cups, speed rails, blender shelves, bottle opener, towel rings, side splashes, soda gun filler section					

Note: Covers not included.

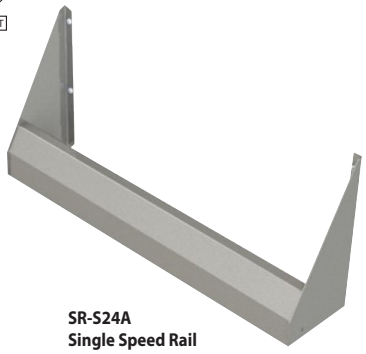


TS END VIEW

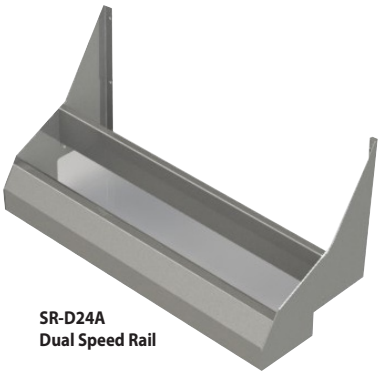
Form No. Z2810
Rev 03.25.22

SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

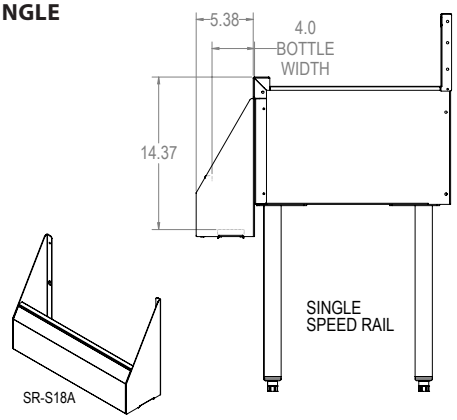
- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

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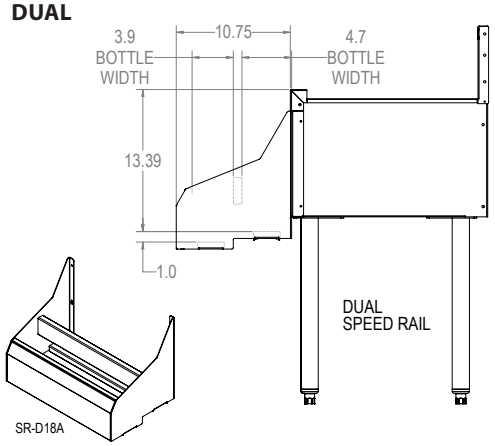
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

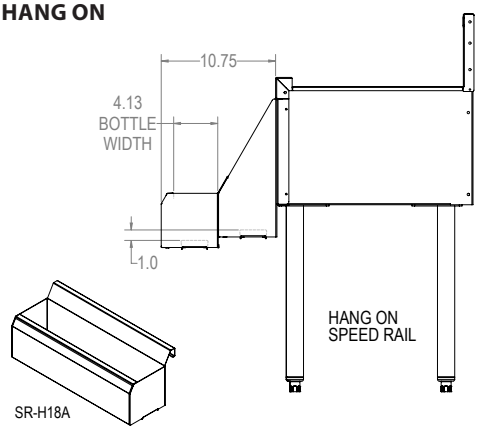
SINGLE



DUAL



HANG ON

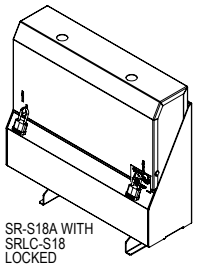


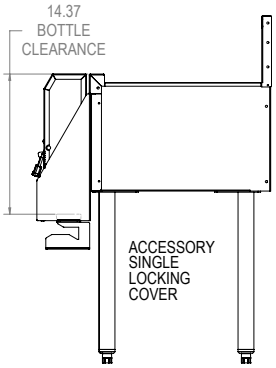
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

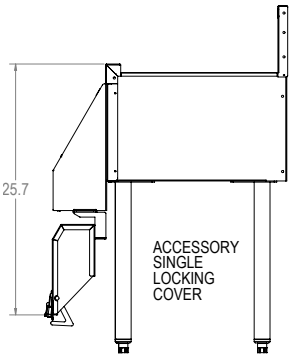
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

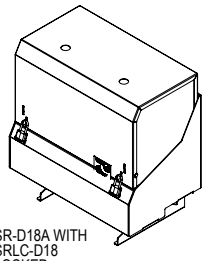


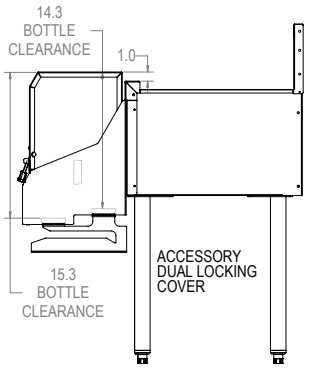


Single cover stored when not in use.

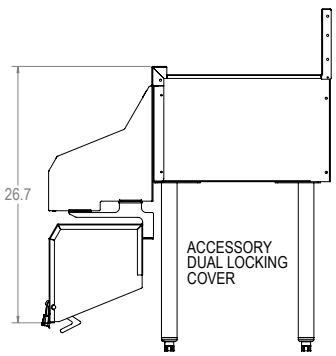


DUAL LOCKING COVERS



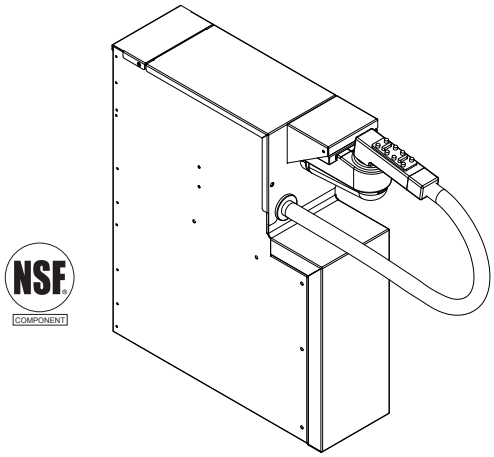


Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

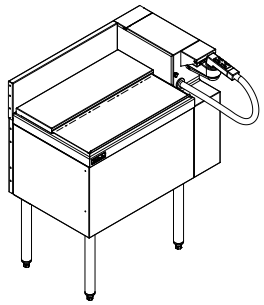
SODA GUN FILLER SECTIONS
TS AND TSF SERIES



JOB	
AREA	
ITEM NO.	
MODEL NO.	

TS4SGB	TS Series Model
TS6SGB	TS Series Model
TSF4SGB	TSF Series Model
TSF6SGB	TSF Series Model

Standard 6″ Backsplash Height



Shown attached to TS24IC10

Note: Soda manifold, hose gun and drip cup NOT included. Shown for clarity of use only.

Features

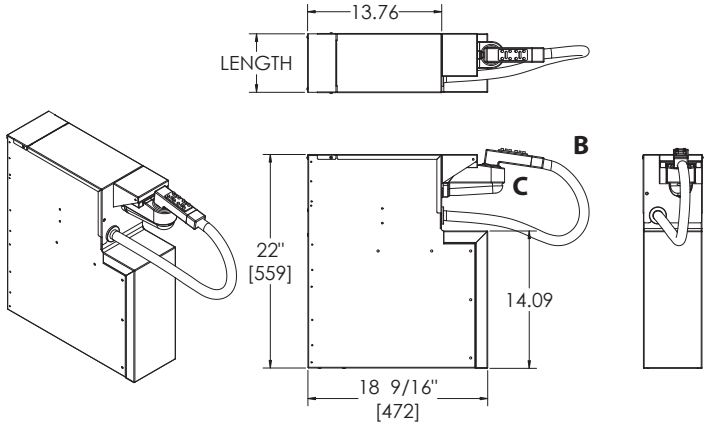
- All stainless steel construction
- Universal design accepts either Wunder-Bar® and Schroeder America™ 8-14 product soda manifolds and drip cups
- Interior mounted manifold conceals unsightly soda lines
- Tool-less removal of Top Cover provides easy service access
- Integrated drip cup mounting allows conceled routing of drip tube to waste drain
- Accessory Speed Rails can by-pass or terminate on Soda Gun Filler
- Speed rails can cross or terminate on soda gun filler.

PRODUCT SPECIFICATION SHEETS ▶ Underbar Soda Gun Filler Sections

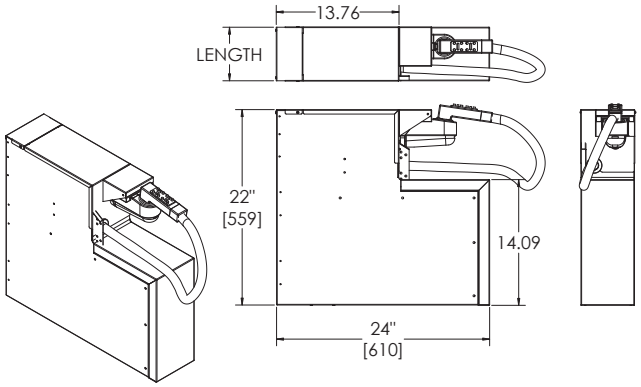
SODA GUN FILLER SECTIONS
TS AND TSF SERIES

Specifications

MODEL NOS.	TS4SGB*	TSF4SGB*	TS6SGB	TSF6SGB
LENGTH IN. (mm)	4" (102)	4" (102)	6" (152)	6" (152)
DEPTH IN. (mm)	18-9/16" (472)	24" (610)	18-9/16" (472)	24" (610)
SHIP WT. LB. (kg)	18 (8.16)	18 (8.16)	18 (8.16)	18 (8.16)
CONSTRUCTION	Stainless Steel			
LEGS	Not applicable, must be mounted to adjacent equipment.			
CAPACITY/APPLICATION	Universal Mounting Brackets accepts "non-flow-control" 8-14 product manifolds from Wunder-Bar® or Schroeder America™ that don't exceed 3" in overall thickness.		Universal Mounting Brackets accepts 8-14 product manifolds from Wunder-Bar® or Schroeder America™	

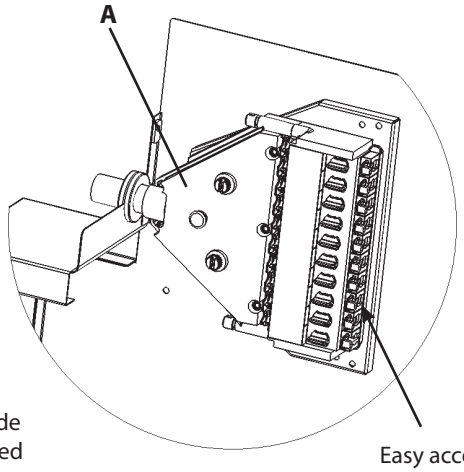


TS6SGB



TSF6SGB

Soda A) manifold; B) hose gun; and C) drip cup
NOT included. Shown for clarity only.



Once assembled, soda lines are out of view (side and cover panel removed for clarity)

Easy access to product line connections

Form No. FS03
Rev. 05.11.2016

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS12DB



TS30DB

MODELS
TS12DB
TS18DB
TS24DB
TS30DB
TS36DB
TS42DB
TS48DB

Other sizes available in 1" increments from 12" up to 30".

KEY PRODUCT FEATURES AND BENEFITS

- Drainboard tops are pitched to the drain, so water is evacuated quickly and effectively. With the matching insert, you still get a flat, level space to store your glassware.
- The default option of 'stadium' shaped perforated inserts enable great air flow for efficient glassware drying, maximize glass storage, and are designed to hold up to a busy bar environment abuse.
- Our new, more robust Perlick Quick Clamp leg attachment still features easy tool-less installation.
- All stainless construction with 18 gauge seamless stainless steel front apron for durability and cleanability.
- All Perlick drainboards are NSF-certified, so you can feel confident knowing your equipment will meet health code standards.

Additional Features:

- Optional Perlick Flex Mount leg relocation kit moves rear legs forward for additional space behind the equipment or moves forward legs rearward to help avoid pesky floor drains, available on TSF units.
- Swap out the perforated insert for a flat top insert when needs change and want to use the drainboard as a workspace Available on 12", 18", 24", 30".
- Stainless steel legs with adjustable thermoplastic feet install without tools for freestanding applications.

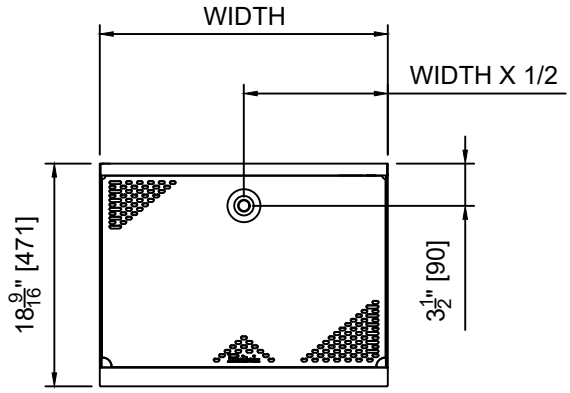
Form No. Z2958
Rev 11.29.23

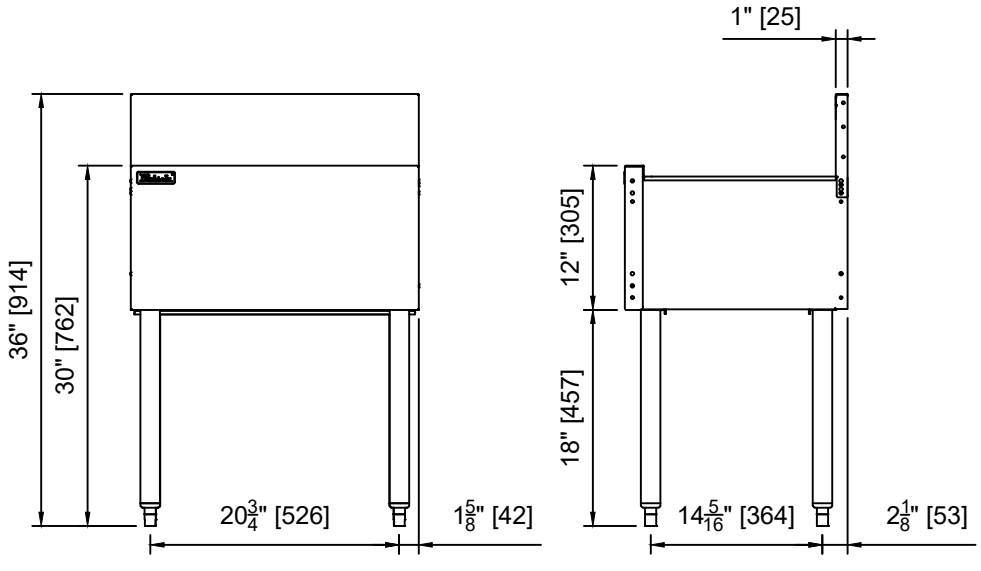
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TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

MODEL NOS.		TS12DB	TS18DB	TS24DB	TS30DB	TS36DB	TS42DB	TS48DB
DIMENSIONS: EXTERIOR	Width In. (mm)	12" (305)	18" (457)	24" (610)	30" (914)	36" (914)	42" (1067)	48" (1219)
	Depth In. (mm)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)
	Weight lb. (kg)	35 (16)	40 (18)	45 (20)	50 (23)	60 (27)	90 (41)	115 (52)
MATERIALS	Construction	All stainless steel						
	Front & Back	Seamless 18 gauge stainless steel						
	Backsplash	6" or 4" high stainless steel with 1" return, fastened and sealed.						
	Drainboard	Pitched stainless steel drainboard top, All horizontal and vertical edges 1/4" radius with balled corners.						
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot						
MECHANICALS	Plumbing	Stainless steel drain socket located back center of the equipment. Drain connection is 1-1/2" NPS male.						
OPTIONAL ACCESSORIES (PARTIAL LIST)		Perforated insert(s), flat top insert(s), speed rails, bottle opener, end splashes, backsplash cutout						

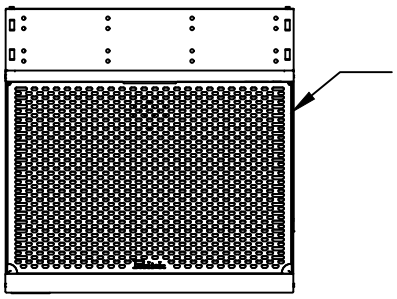




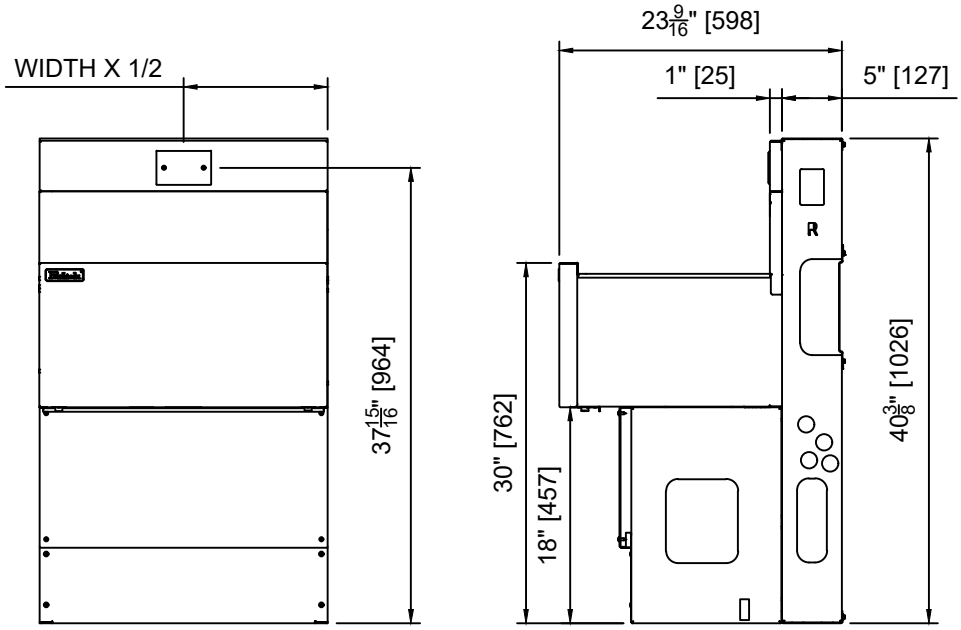
Form No. Z2958
Rev 11.29.23

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

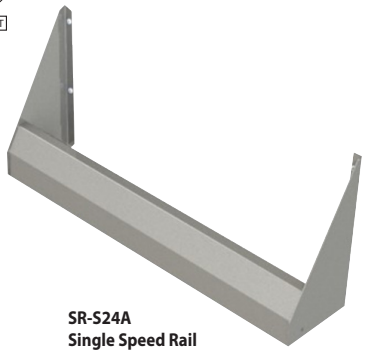


SHOWN WITH FULL
DRAINBOARD INSERT

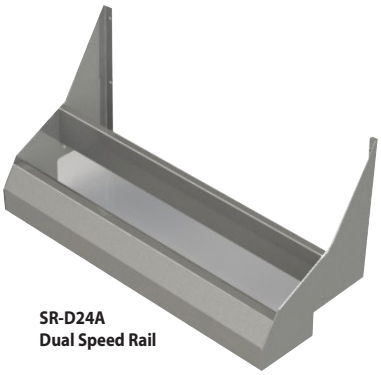


SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

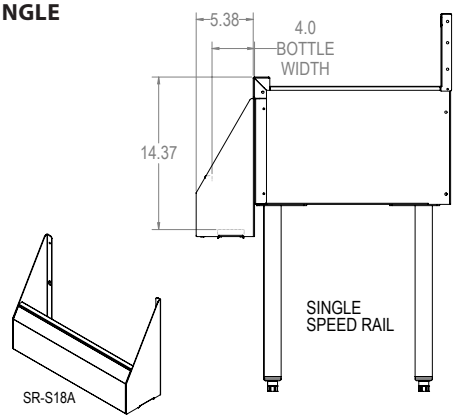
Form No. Z2462
Rev. 01.24.22

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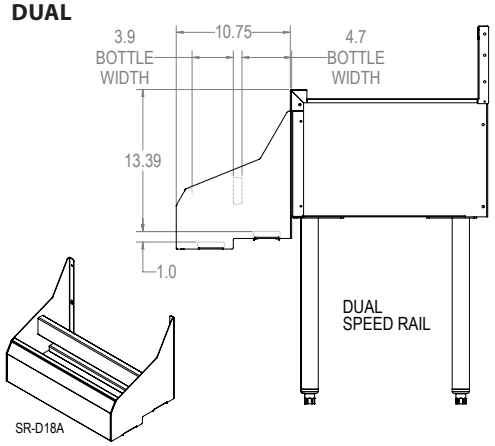
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

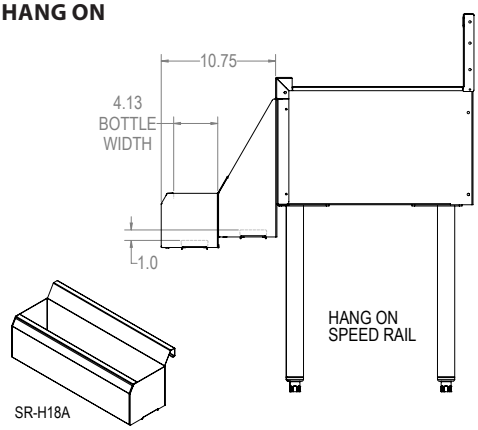
SINGLE



DUAL



HANG ON

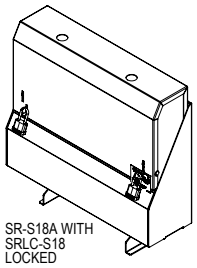


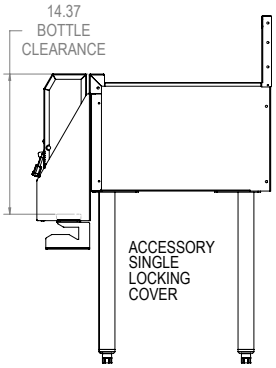
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

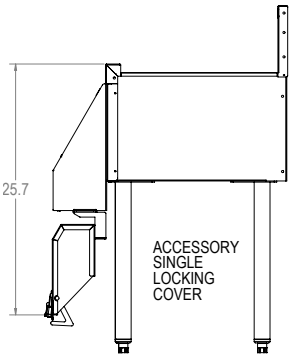
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

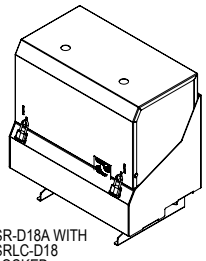


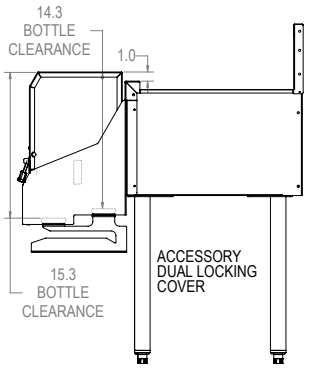


Single cover stored when not in use.

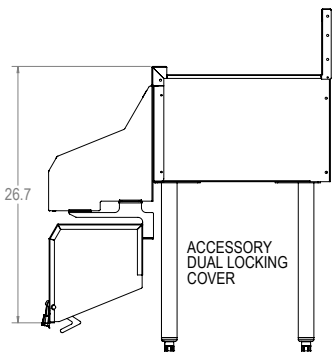


DUAL LOCKING COVERS





Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS
TS12DB
TS18DB
TS24DB
TS30DB
TS36DB
TS42DB
TS48DB

Other sizes available in 1" increments from 12" up to 30".



TS12DB



TS30DB

KEY PRODUCT FEATURES AND BENEFITS

- Drainboard tops are pitched to the drain, so water is evacuated quickly and effectively. With the matching insert, you still get a flat, level space to store your glassware.
- The default option of 'stadium' shaped perforated inserts enable great air flow for efficient glassware drying, maximize glass storage, and are designed to hold up to a busy bar environment abuse.
- Our new, more robust Perlick Quick Clamp leg attachment still features easy tool-less installation.
- All stainless construction with 18 gauge seamless stainless steel front apron for durability and cleanability.
- All Perlick drainboards are NSF-certified, so you can feel confident knowing your equipment will meet health code standards.

Additional Features:

- Optional Perlick Flex Mount leg relocation kit moves rear legs forward for additional space behind the equipment or moves forward legs rearward to help avoid pesky floor drains, available on TSF units.
- Swap out the perforated insert for a flat top insert when needs change and want to use the drainboard as a workspace Available on 12", 18", 24", 30".
- Stainless steel legs with adjustable thermoplastic feet install without tools for freestanding applications.

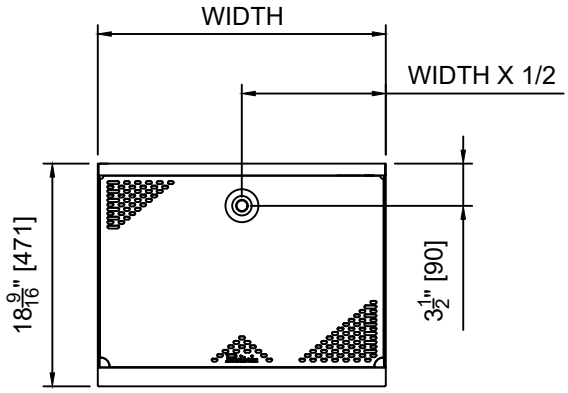
Form No. Z2958
Rev 11.29.23

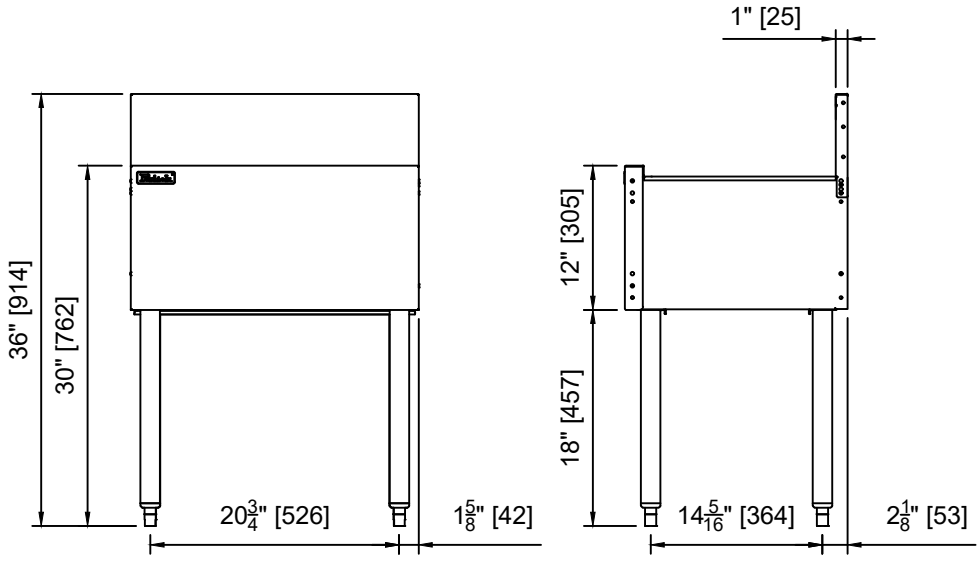
PERLICK CORPORATION 8300 W. Good Hope Rd., Milwaukee, WI 53223 • (800) 558-5592 • perlick.com

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

MODEL NOS.		TS12DB	TS18DB	TS24DB	TS30DB	TS36DB	TS42DB	TS48DB
DIMENSIONS: EXTERIOR	Width In. (mm)	12" (305)	18" (457)	24" (610)	30" (914)	36" (914)	42" (1067)	48" (1219)
	Depth In. (mm)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)
	Weight lb. (kg)	35 (16)	40 (18)	45 (20)	50 (23)	60 (27)	90 (41)	115 (52)
MATERIALS	Construction	All stainless steel						
	Front & Back	Seamless 18 gauge stainless steel						
	Backsplash	6" or 4" high stainless steel with 1" return, fastened and sealed.						
	Drainboard	Pitched stainless steel drainboard top, All horizontal and vertical edges 1/4" radius with balled corners.						
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot						
MECHANICALS	Plumbing	Stainless steel drain socket located back center of the equipment. Drain connection is 1-1/2" NPS male.						
OPTIONAL ACCESSORIES (PARTIAL LIST)		Perforated insert(s), flat top insert(s), speed rails, bottle opener, end splashes, backsplash cutout						

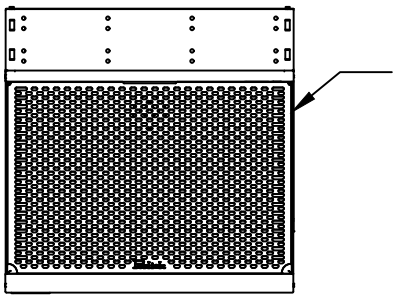




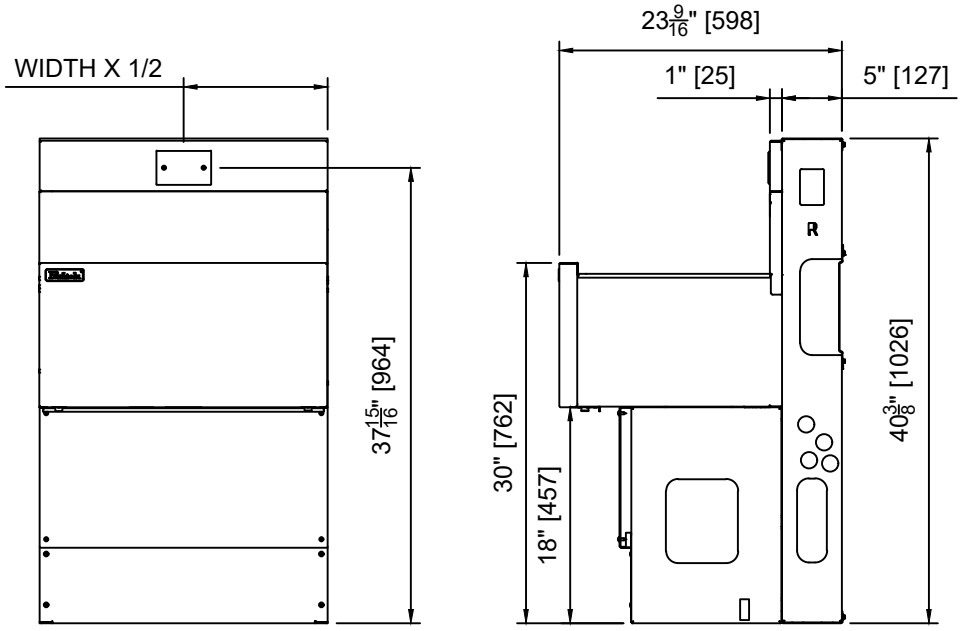
Form No. Z2958
Rev 11.29.23

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

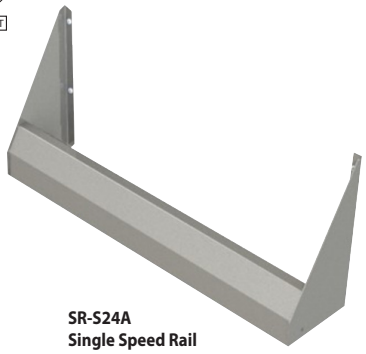


SHOWN WITH FULL
DRAINBOARD INSERT

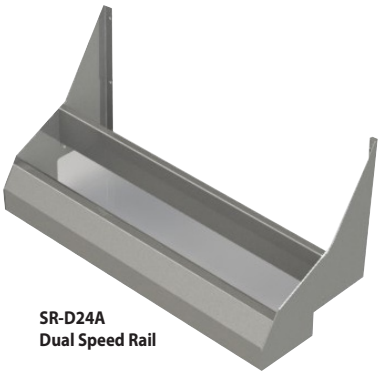


SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

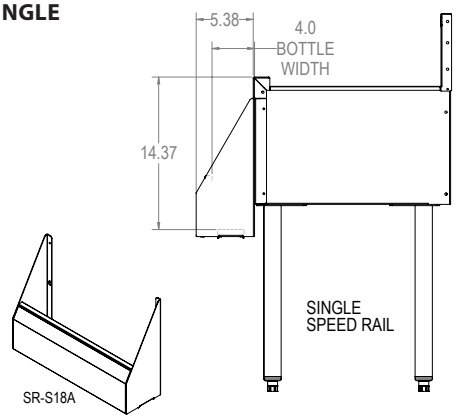
- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

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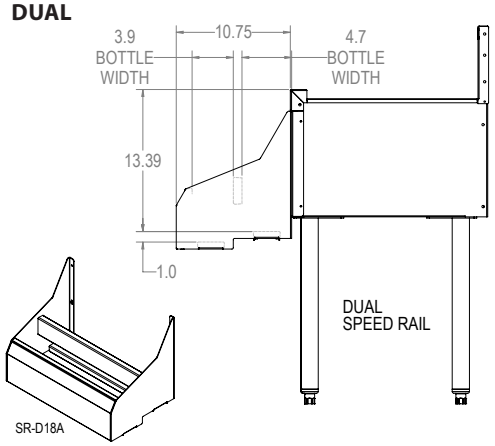
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

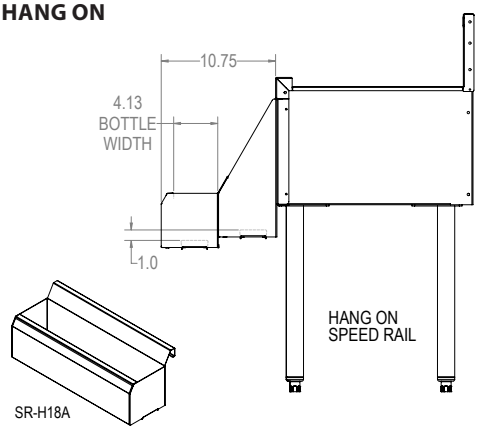
SINGLE



DUAL



HANG ON

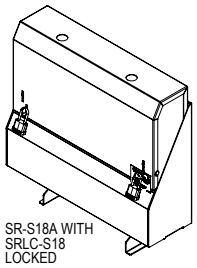


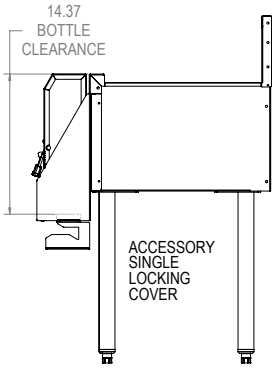
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

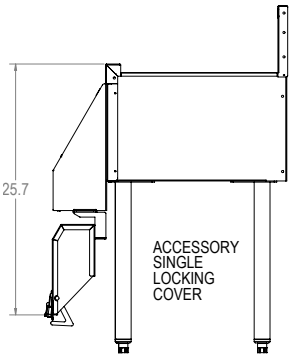
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

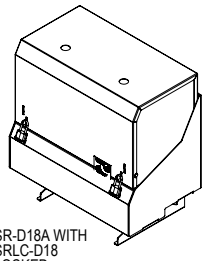


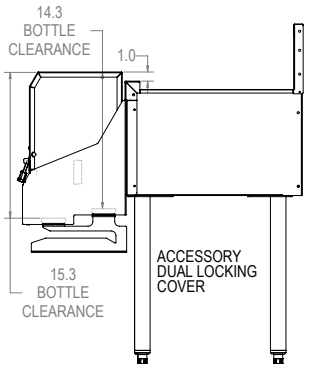


Single cover stored when not in use.

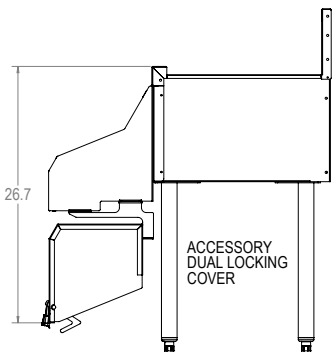


DUAL LOCKING COVERS





Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

UNDERBAR ICE CHESTS

TS Series Ice Chests

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS24IC10

MODELS	
Cold Plate	**Non-Cold Plate**
	TS18IC
TS24IC10	TS24IC
TS30IC10	TS30IC
TS36IC10	TS36IC
TS42IC10	TS42IC
TS48IC10	TS48IC

KEY PRODUCT FEATURES AND BENEFITS

- All stainless for durable easy to clean surfaces
- Fully insulated to reduce ice melt in warm climates
- Highly efficient cold plates instantly chill your soft drinks to the correct temperature
- Eco-friendly foam insulation is efficient and has zero impact on global warming or ozone depletion
- Stainless steel legs with adjustable thermoplastic feet are strong and install easily without tools
- Available with or without a cold plate to suit your bartender's needs

Quick Features:

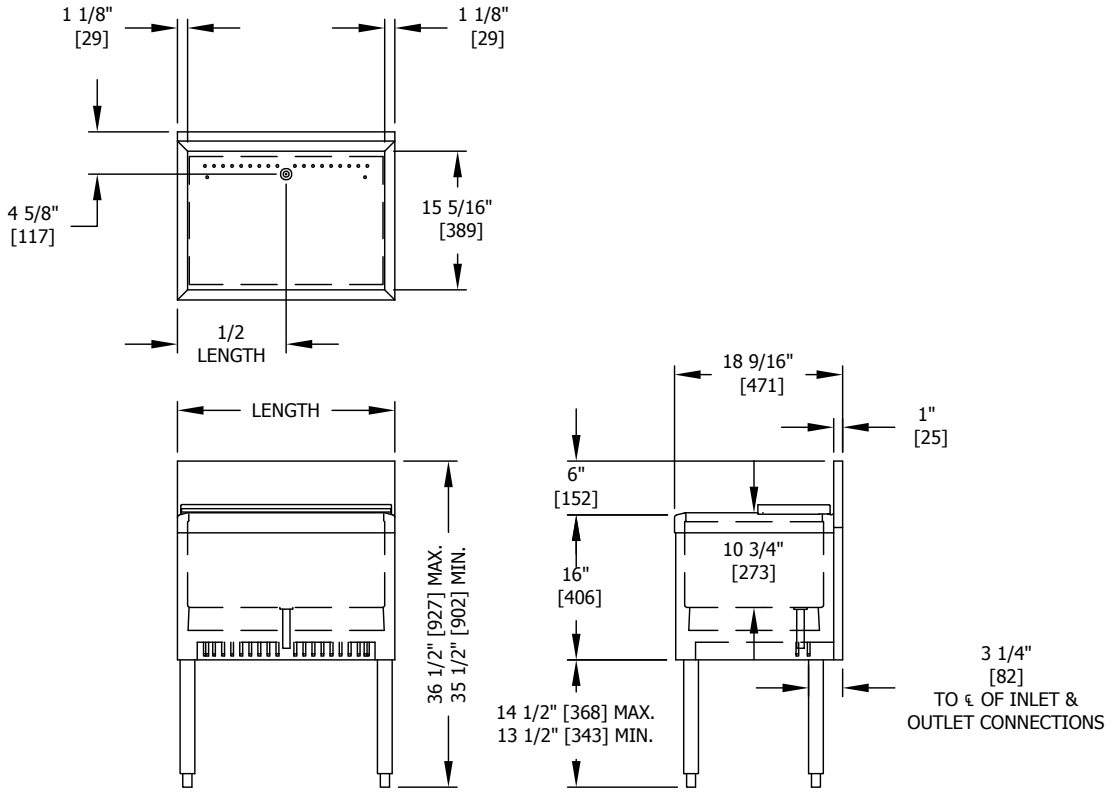
- Fully insulated with highly efficient eco-friendly polyurethane foam
- Built with stainless steel to maximize the lifespan
- Boldly innovative cold plate design increases thermo efficiency to instantly chill your soft drink to the right temperature

UNDERBAR ICE CHESTS

TS Series Ice Chests

MODEL NOS.							
MODEL TYPE:	Non-Cold Plate Models	**TS18IC**	**TS24IC**	**TS30IC**	**TS36IC**	**TS42IC**	**TS48IC**
	Cold Plate Models	**NA**	**TS24IC10**	**TS30IC10**	**TS36IC10**	**TS42IC10**	**TS48IC10**
DIMENSIONS: EXTERIOR (mm)	Length, Inches (mm)	18 (457)	24 (610)	30 (762)	36 (914)	42 (1067)	48 (1219)
	Ice Capacity, lbs. (kg)	60 (27.2)	80 (36.3)	100 (45.4)	125 (56.7)	145 (65.8)	165 (74.8)
	Ship Weight with cold plate lb/kg	NA	81 (36.5)	86 (39)	92 (41.5)	98 (44.4)	103 (46.7)
	Ship Weight without cold plate lb/kg	28 (12.7)	34 (15.3)	38 (17.2)	45 (20.3)	50 (22.7)	55 (25.1)
MATERIALS	Front & Sides	Stainless Steel					
	Backsplash	Stainless steel, 6" high, (4" optional), with 1" return at top, mechanically fastened and sealed to ice chest top with steel support brackets					
	Back & Bottom	Galvanized steel					
	Interior	Stainless steel with 1/4" Radius corners, welded, polished, and sealed with non-exposed cold plate. Interiors can be divided with accessory freestanding ice bin dividers.					
	Insulation	Eco-friendly foamed-in-place polyurethane					
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot					
	Top Rim	ABS					
MECHANICALS	Plumbing	Drain connection– 1-1/2" NPS male					
	Cold Plate	Cast aluminum plate concealed under ice chest liner. Cold plate has 2 full-length circuits and 8 half length circuits. **Connections** – 5/16" O.D. stainless steel tubing with swaged end to accept standard 1/4" I.D. beverage tubing					
OPERATING SPECIFICATIONS	Cold Plate	Each full circuit will deliver four 6 oz. drinks per minute at 40° continuously, or 40 oz. every three minutes in a single draw (flow rate 2 oz./sec, 75° product)					
MISCELLANEOUS	Accessories *(Ordered separately)*	Covers, ice bin dividers, condiment trays with cups, speed rails, blender shelves, bottle opener, towel rings, side splashes, soda gun filler section					

Note: Covers not included.

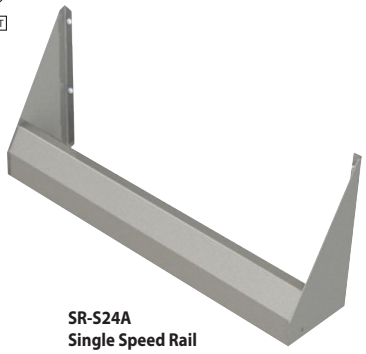


TS END VIEW

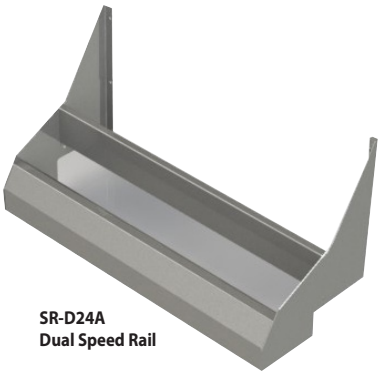
Form No. Z2810
Rev 03.25.22

SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

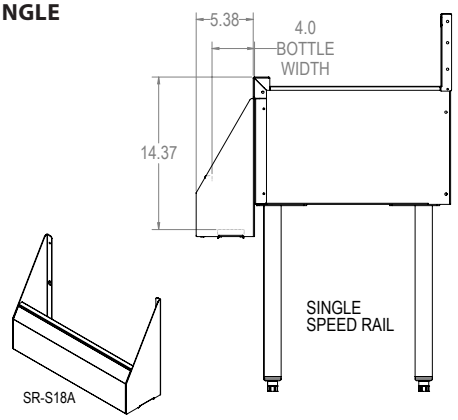
- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

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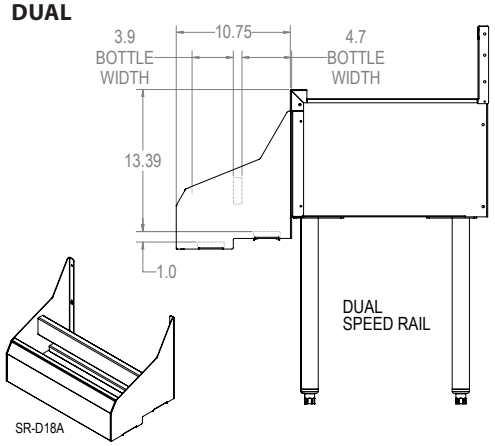
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

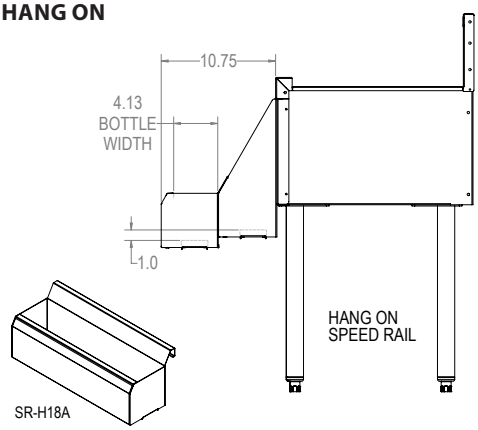
SINGLE



DUAL



HANG ON

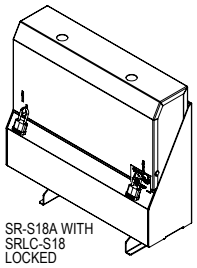


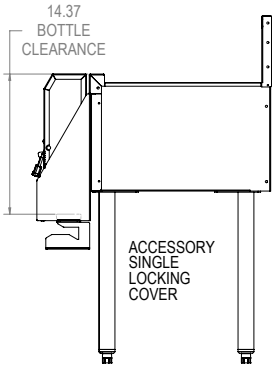
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

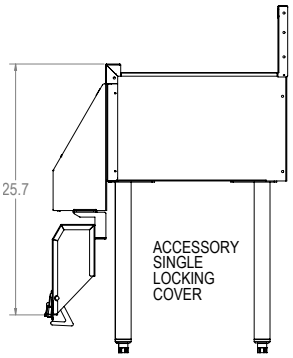
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

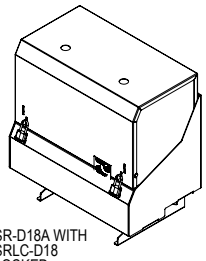


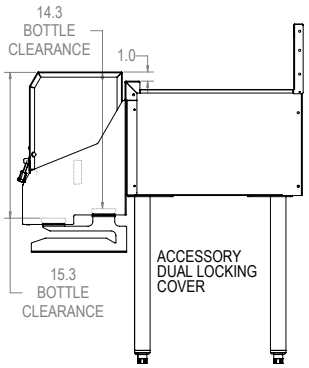


Single cover stored when not in use.

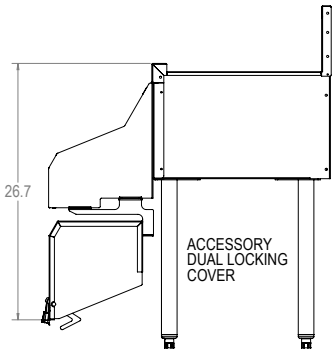


DUAL LOCKING COVERS



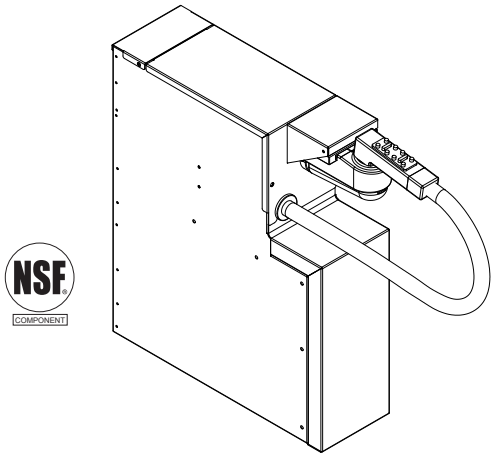


Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

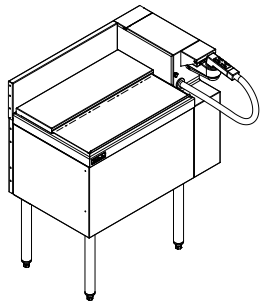
SODA GUN FILLER SECTIONS
TS AND TSF SERIES



JOB	
AREA	
ITEM NO.	
MODEL NO.	

TS4SGB	TS Series Model
TS6SGB	TS Series Model
TSF4SGB	TSF Series Model
TSF6SGB	TSF Series Model

Standard 6″ Backsplash Height



Shown attached to TS24IC10

Note: Soda manifold, hose gun and drip cup NOT included. Shown for clarity of use only.

Features

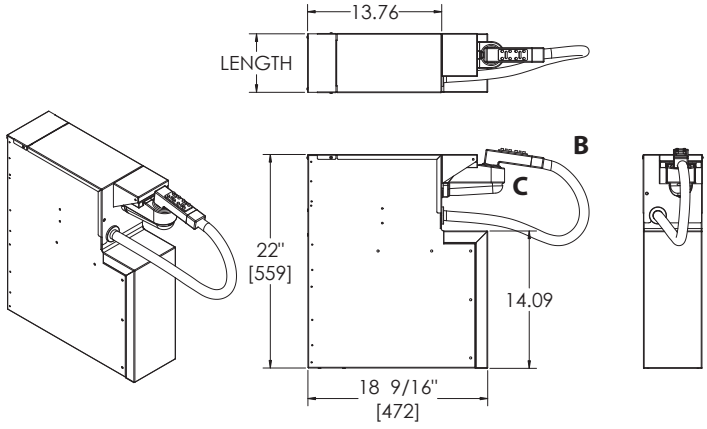
- All stainless steel construction
- Universal design accepts either Wunder-Bar® and Schroeder America™ 8-14 product soda manifolds and drip cups
- Interior mounted manifold conceals unsightly soda lines
- Tool-less removal of Top Cover provides easy service access
- Integrated drip cup mounting allows conceled routing of drip tube to waste drain
- Accessory Speed Rails can by-pass or terminate on Soda Gun Filler
- Speed rails can cross or terminate on soda gun filler.

PRODUCT SPECIFICATION SHEETS ▶ Underbar Soda Gun Filler Sections

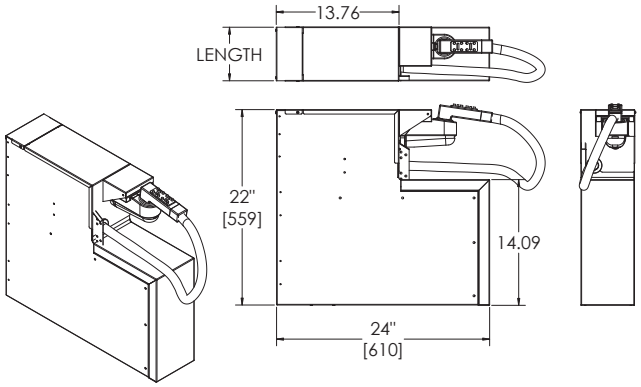
SODA GUN FILLER SECTIONS
TS AND TSF SERIES

Specifications

MODEL NOS.	TS4SGB*	TSF4SGB*	TS6SGB	TSF6SGB
LENGTH IN. (mm)	4" (102)	4" (102)	6" (152)	6" (152)
DEPTH IN. (mm)	18-9/16" (472)	24" (610)	18-9/16" (472)	24" (610)
SHIP WT. LB. (kg)	18 (8.16)	18 (8.16)	18 (8.16)	18 (8.16)
CONSTRUCTION	Stainless Steel			
LEGS	Not applicable, must be mounted to adjacent equipment.			
CAPACITY/APPLICATION	Universal Mounting Brackets accepts "non-flow-control" 8-14 product manifolds from Wunder-Bar® or Schroeder America™ that don't exceed 3" in overall thickness.		Universal Mounting Brackets accepts 8-14 product manifolds from Wunder-Bar® or Schroeder America™	

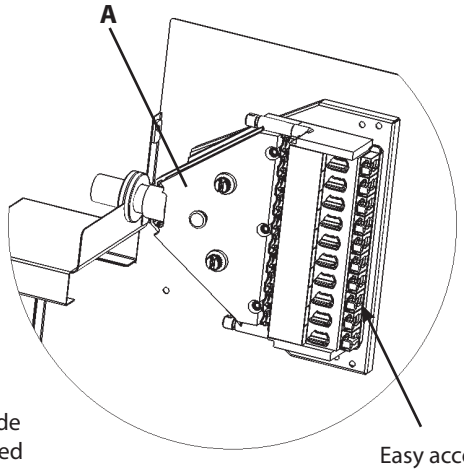


TS6SGB



TSF6SGB

Soda A) manifold; B) hose gun; and C) drip cup
NOT included. Shown for clarity only.



Once assembled, soda lines are out of view (side and cover panel removed for clarity)

Easy access to product line connections

Form No. FS03
Rev. 05.11.2016

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS12DB



TS30DB

MODELS
TS12DB
TS18DB
TS24DB
TS30DB
TS36DB
TS42DB
TS48DB

Other sizes available in 1" increments from 12" up to 30".

KEY PRODUCT FEATURES AND BENEFITS

- Drainboard tops are pitched to the drain, so water is evacuated quickly and effectively. With the matching insert, you still get a flat, level space to store your glassware.
- The default option of 'stadium' shaped perforated inserts enable great air flow for efficient glassware drying, maximize glass storage, and are designed to hold up to a busy bar environment abuse.
- Our new, more robust Perlick Quick Clamp leg attachment still features easy tool-less installation.
- All stainless construction with 18 gauge seamless stainless steel front apron for durability and cleanability.
- All Perlick drainboards are NSF-certified, so you can feel confident knowing your equipment will meet health code standards.

Additional Features:

- Optional Perlick Flex Mount leg relocation kit moves rear legs forward for additional space behind the equipment or moves forward legs rearward to help avoid pesky floor drains, available on TSF units.
- Swap out the perforated insert for a flat top insert when needs change and want to use the drainboard as a workspace Available on 12", 18", 24", 30".
- Stainless steel legs with adjustable thermoplastic feet install without tools for freestanding applications.

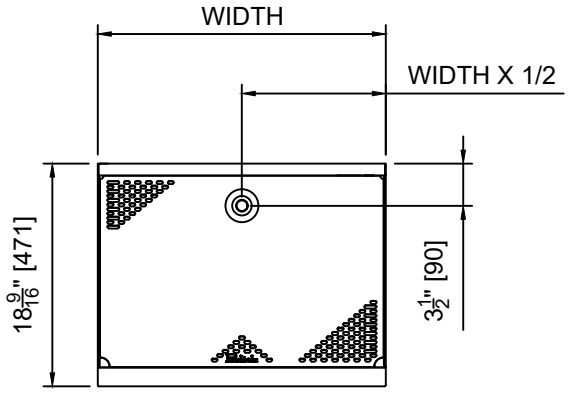
Form No. Z2958
Rev 11.29.23

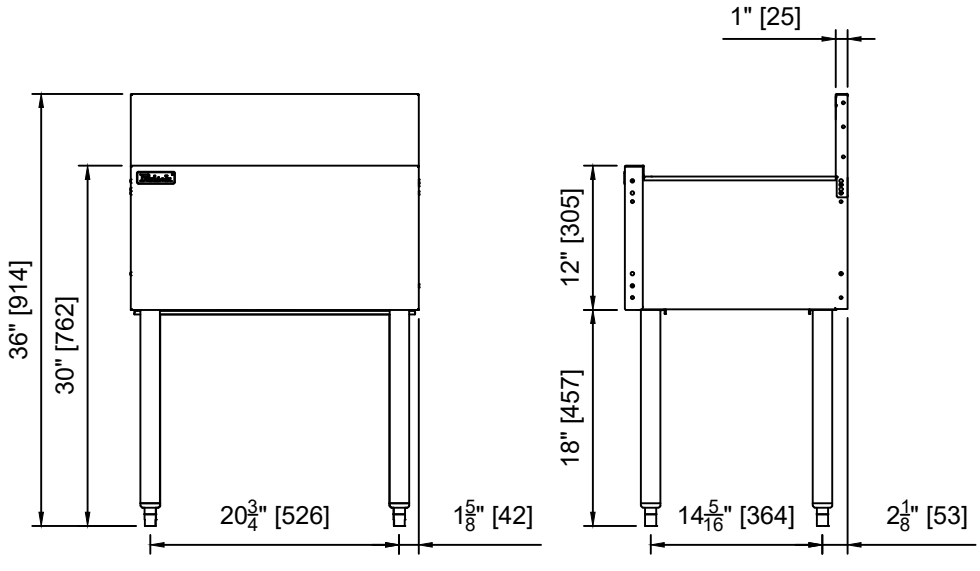
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TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

MODEL NOS.		TS12DB	TS18DB	TS24DB	TS30DB	TS36DB	TS42DB	TS48DB
DIMENSIONS: EXTERIOR	Width In. (mm)	12" (305)	18" (457)	24" (610)	30" (914)	36" (914)	42" (1067)	48" (1219)
	Depth In. (mm)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)
	Weight lb. (kg)	35 (16)	40 (18)	45 (20)	50 (23)	60 (27)	90 (41)	115 (52)
MATERIALS	Construction	All stainless steel						
	Front & Back	Seamless 18 gauge stainless steel						
	Backsplash	6" or 4" high stainless steel with 1" return, fastened and sealed.						
	Drainboard	Pitched stainless steel drainboard top, All horizontal and vertical edges 1/4" radius with balled corners.						
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot						
MECHANICALS	Plumbing	Stainless steel drain socket located back center of the equipment. Drain connection is 1-1/2" NPS male.						
OPTIONAL ACCESSORIES (PARTIAL LIST)		Perforated insert(s), flat top insert(s), speed rails, bottle opener, end splashes, backsplash cutout						

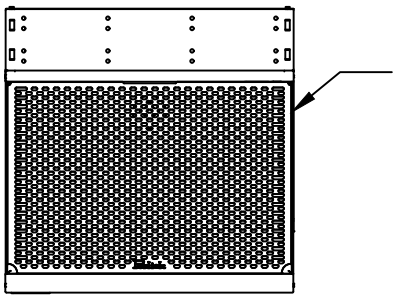




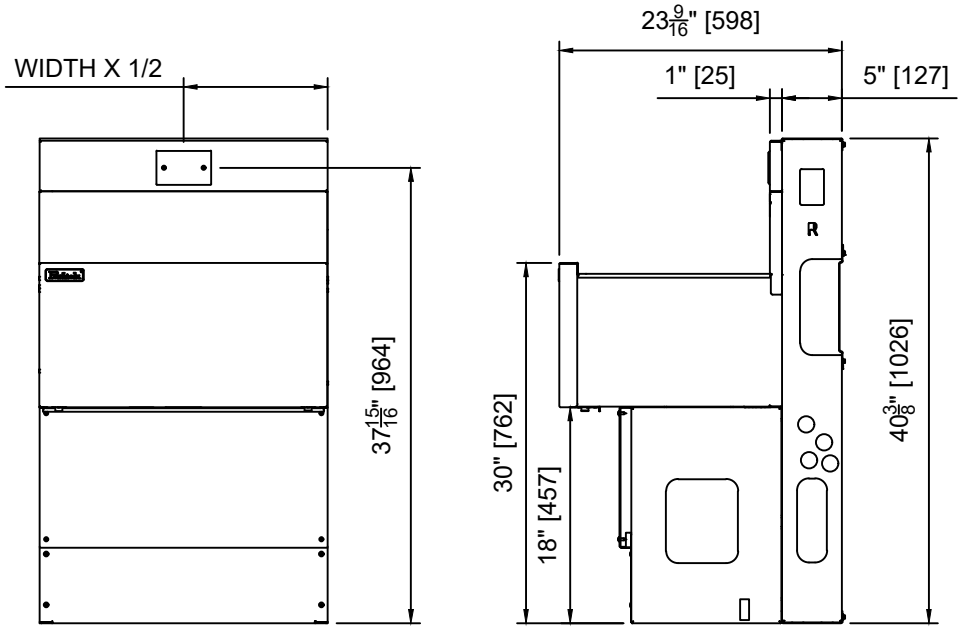
Form No. Z2958
Rev 11.29.23

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

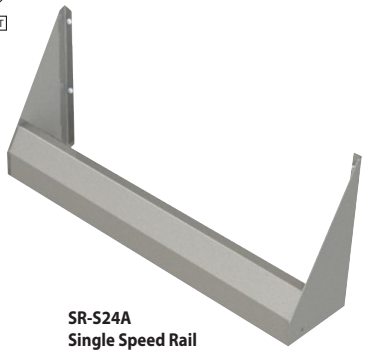


SHOWN WITH FULL
DRAINBOARD INSERT

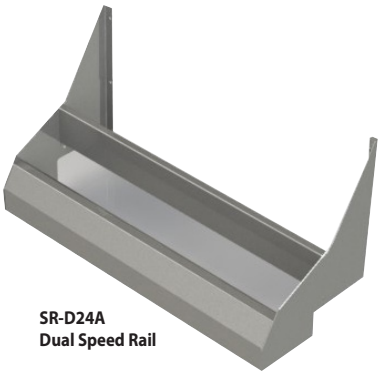


SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

NSF COMPONENT



SR-S24A
Single Speed Rail



SR-D24A
Dual Speed Rail



SR-H24A
Hang on Speed Rail



SRLC-S24
Single Locking
Speed Rail Cover

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS	
SR-SXXA	Single Speed Rail
SR-DXXA	Dual Speed Rail
SR-HXXA	Hang On Speed Rail
SRLC-SXX	Single Locking Speed Rail Cover
SRLC-DXX	Dual Locking Speed Rail Cover

KEY PRODUCT FEATURES AND BENEFITS

- 5-1/8" front panel improves bottle retention and prevents bottles from tipping forward
- Lower bottle height provides improved clearance to ice bin
- Plastic extrusion on bottom support provides sound deadening
- Plastic clear extrusion on front top edge of rail provides sound deadening and protection for bottle location labels

Quick Features:

- Single or Dual tier models to fit your storage needs
- Locking covers are available to secure your inventory
- Stainless steel construction for durability
- Supplemental "hang-on" lengths for added storage when needed
- Sound-deadening work surfaces for quiet operation

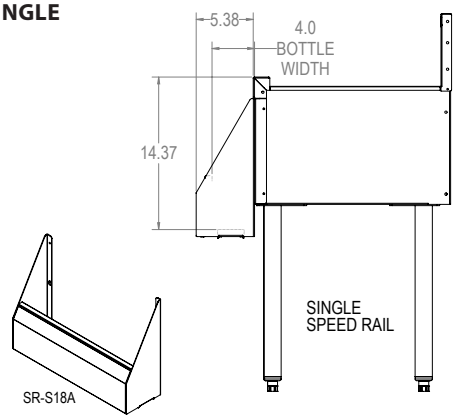
Form No. Z2462
Rev. 01.24.22

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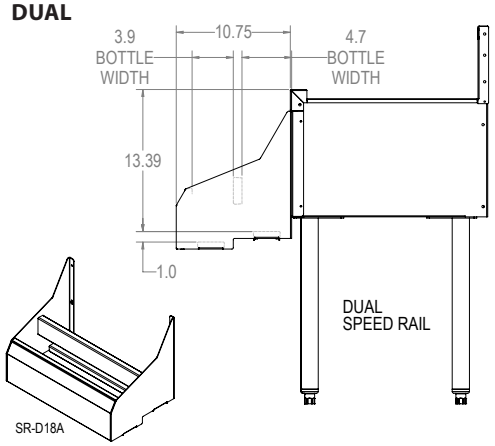
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

SPEED RAILS			
LENGTH INCHES (MM)	**SINGLE SPEED RAIL PART NO.**	**DOUBLE SPEED RAIL PART NO.**	**HANG ON SPEED RAIL PART NO.**
12" (305)	SR-S12A	SR-D12A	SR-H12A
13" (330)	SR-S13A	SR-D13A	SR-H13A
14" (356)	SR-S14A	SR-D14A	SR-H14A
15" (381)	SR-S15A	SR-D15A	SR-H15A
16" (406)	SR-S16A	SR-D16A	SR-H16A
17" (432)	SR-S17A	SR-D17A	SR-H17A
18" (457)	SR-S18A	SR-D18A	SR-H18A
19" (483)	SR-S19A	SR-D19A	SR-H19A
20" (508)	SR-S20A	SR-D20A	SR-H20A
21" (533)	SR-S21A	SR-D21A	SR-H21A
22" (559)	SR-S22A	SR-D22A	SR-H22A
23" (584)	SR-S23A	SR-D23A	SR-H23A
24" (610)	SR-S24A	SR-D24A	SR-H24A
28" (711)	SR-S28A	SR-D28A	SR-H28A
30" (762)	SR-S30A	SR-D30A	SR-H30A
34" (864)	SR-S34A	SR-D34A	SR-H34A
36" (914)	SR-S36A	SR-D36A	SR-H36A
42" (1067)	SR-S42A	SR-D42A	
48" (1219)	SR-S48A	SR-D48A	
54" (1372)	SR-S54A		
60" (1372)	SR-S60A		
66" (1676)	SR-S66A		
72" (1829)	SR-S72A		
78" (1981)	SR-S78A		
84" (2134)	SR-S84A		
90" (2286)	SR-S90A		
96" (2438)	SR-S96A		

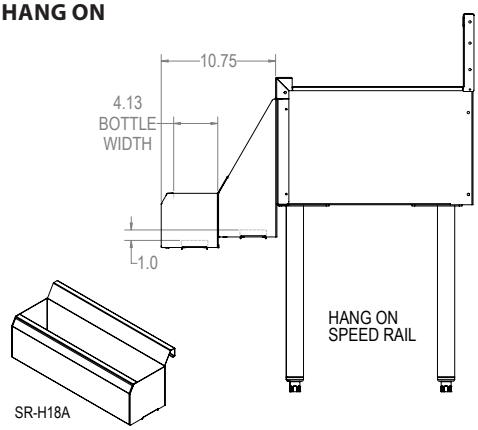
SINGLE



DUAL



HANG ON

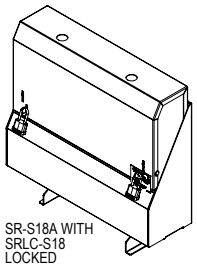


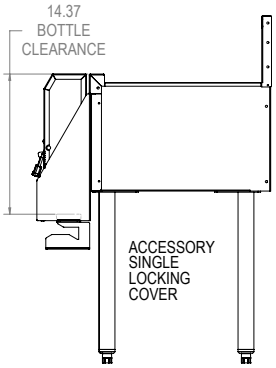
SINGLE, DUAL AND HANG ON SPEED RAILS
SINGLE AND DUAL ACCESSORY LOCKING COVERS

ACCESSORY LOCKING COVERS COVER ONLY)		
LENGTH INCHES (MM)	**SINGLE LOCKING COVER PART NO.**	**DUAL LOCKING COVER PART NO.**
12" (305)	SRLC-S12	SRLC-D12
13" (330)	SRLC-S13	SRLC-D13
14" (356)	SRLC-S14	SRLC-D14
15" (381)	SRLC-S15	SRLC-D15
16" (406)	SRLC-S16	SRLC-D16
17" (432)	SRLC-S17	SRLC-D17
18" (457)	SRLC-S18	SRLC-D18
19" (483)	SRLC-S19	SRLC-D19
20" (508)	SRLC-S20	SRLC-D20
21" (533)	SRLC-S21	SRLC-D21
22" (559)	SRLC-S22	SRLC-D22
23" (584)	SRLC-S23	SRLC-D23
24" (610)	SRLC-S24	SRLC-D24
28" (711)	SRLC-S28	SRLC-D28
30" (762)	SRLC-S30	SRLC-D30
34" (864)	SRLC-S34	SRLC-D34
36" (914)	SRLC-S36	SRLC-D36
42" (1067)	SRLC-S42	SRLC-D42
48" (1219)	SRLC-S48	SRLC-D48
54" (1372)	SRLC-S54	
60" (1372)	SRLC-S60	
66" (1676)	SRLC-S66	
72" (1829)	SRLC-S72	
78" (1981)	SRLC-S78	
84" (2134)	SRLC-S84	
90" (2286)	SRLC-S90	
96" (2438)	SRLC-S96	

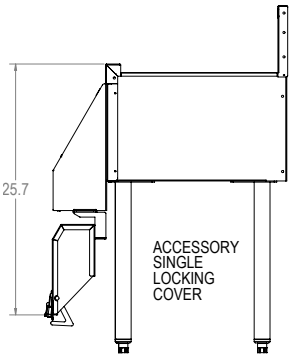
- Heavy duty 18 ga. stainless steel construction for strength and security
- Perlick-exclusive design includes convenient, built-in storage solution
- For speed rails longer than 48", the locking covers consist of 2 sections for easy handling
- Locking cover kit includes cover, brackets, hardware and padlocks **Speed rails sold seperately*
- For field installed add R suffix

SINGLE LOCKING COVERS

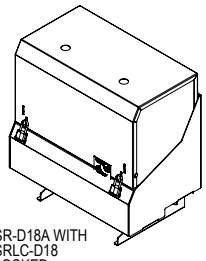


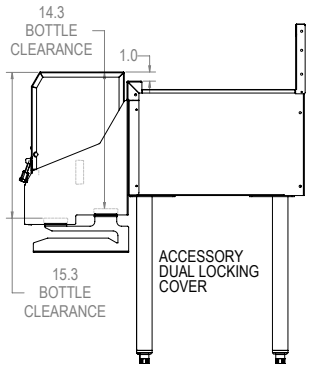


Single cover stored when not in use.

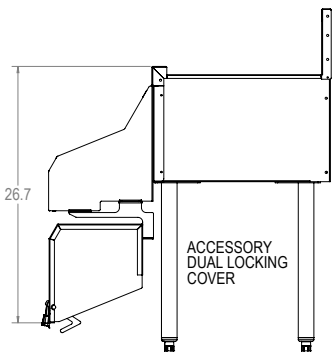


DUAL LOCKING COVERS





Dual cover stored when not in use.



Form No. Z2462
Rev. 01.21.22

PRODUCT SPECIFICATION SHEETS ▶ Refrigerated Cabinets

SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

NSF | c UL us | 5 Year Compressor Warranty | eco friendly R290 Hydrocarbon Refrigerant

JOB
AREA
ITEM NO.
MODEL NO.



BBS36 with optional glass w/stainless steel door shown



BBS36 with optional liquor drawers shown

Models	Description
BBS36	1-Door Model
BBS60	2-Door Model
BBS84	3-Door Model
BBS108	4-Door Model

KEY PRODUCT FEATURES AND BENEFITS

- Stainless steel interior & top standard on all perlick Back Bar refrigeration for long life durability and easy to clean hygienic storage
- 2" Foamed-in-place eco-friendly insulation provides energy savings with zero ozone depletion
- NSF/ANSI Standard 7 Listed for open food, beverage, and garnish storage
- End wall compressor & evaporator design increases storage capacity by 14% compared to top mounted designs
- Anti-Sweat heaters prevent condensation from forming, extending door gasket life and protecting flooring below from damage or slip hazards
- Multiple door and drawer styles available in any compartment:
    - Choose between Glass, Stainless-Steel, or Black Vinyl or Customer Provided Overlay
    - Choose between Refrigerator, Wine, or Liquor Drawers designed by Tobin Ellis

Quick Features

- Integrated door & drawer locks standard on all units
- Choose compressor mounted on left or right side of cabinet to match your space
- NSF Rated digital controller allows for easy and precise temperature changes
- Choose between three temperature ranges
    - Refrigerator (34°F-42°F) Factory set to 38°F
    - White Wine (40°F-65°F) Factory set to 45°F
    - Red Wine (40°F-65°F) Factory set to 60°F
- Choose between 6000K white LED lighting or cool blue display lighting
- 1 Year Parts and Labor Warranty, 5 Year Compressor Warranty
- Made in USA

Form No. 95176
Rev. 06.16.2022

SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

MODEL NUMBERS		BBS36	BBS60	BBS84	BBS108
NUMBER OF COMPARTMENTS/DOORS		1	2	3	4
EXTERIOR CABINET DIMENSIONS	Length - in. (mm)	36 (914)	60 (1524)	84 (2134)	108 (2743)
	Depth - in. (mm)	24¾ (629)	24¾ (629)	24¾ (629)	24¾ (629)
	Height - in. (mm)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)
INTERIOR CABINET DIMENSIONS	Length - in. (mm)	20 (508)	44 (1118)	68 (1727)	92 (2337)
	Depth - in. (mm)	18¾ (476)	18¾ (476)	18¾ (476)	18¾ (476)
	Height - in. (mm)	28½ (724)	28½ (724)	28½ (724)	28½ (724)
INTERNAL VOLUME Net. Cu. Ft. (Litres)		7.4 (210)	16 (453)	24.8 (702)	33.5 (949)
PRODUCT CAPACITY	CASE PACK - 12 OZ. BOTTLE/CAN	182/273	371/553	581/868	791/1183
	STAGGERED - 12 OZ. BOTTLE/CAN	196/292	400/592	628/932	856/1272
SHIPPING WEIGHT Lbs. (kg.)		254 (115)	340 (154k)	490 (222)	671 (304)
ELECTRICAL SPECIFICATIONS	Electrical Supply	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph
	Running Load Amps	1.8	2.5	4.2	4.2
	Electrical Connection	Cord connected	Cord connected	Cord connected	Cord connected
	Cord Plug Type	NEMA 5-15	NEMA 5-15	NEMA 5-15	NEMA 5-15
	Cord Length	6'5"	6'5"	6'5"	6'5"
	Defrost Initiation	Automatic	Automatic	Automatic	Automatic
	Defrost Type	Off cycle	Off cycle	Off cycle	Off cycle
	Thermostat	Digital control	Digital control	Digital control	Digital control
	Lighting Type	LED	LED	LED	LED
REFRIGERATION SPECIFICATIONS	Horsepower	1/6	1/5	1/4	1/4
	Refrigerant	R290	R290	R290	R290
	Refrigerant Charge (grams)	90	100	90	90
	Total Heat Rejection at 75F ambient (BTU/hr)	900	1900	2300	2300
	Factory Temperature Setting - Refrigerator F (C)	38° (3.3°)	38° (3.3°)	38° (3.3°)	38° (3.3°)
	Temperature Range - Refrigerator F (C)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)
	Factory Temperature Setting - White Wine F (C)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)
	Factory Temperature Setting - Red Wine F (C)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)
	Temperature Range - Wine F (C)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)
	Condensing Unit Location	Left or Right	Left or Right	Left or Right	Left or Right
	Expansion Device	Capillary tube	Capillary tube	Capillary tube	Capillary tube
	Pull-Out Condensing Unit	Yes	Yes	Yes	Yes
	Front Vented	Yes	Yes	Yes	Yes
PLUMBING		None required	None required	None required	None required

Note: *Wine Temperature refrigerators do not carry NSF Rating for open food storage. Wine Temperature units are NSF Certified for non-potentially hazardous bottled and canned beverage storage.*
Maximum of 2 drawer compartments can be selected for BBS84 and BBS108 models

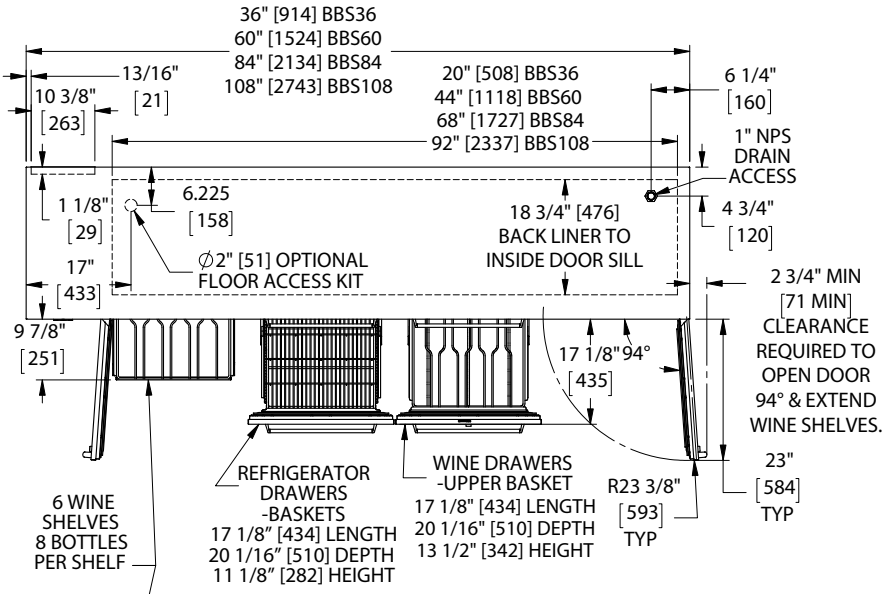
Form No. 95176
Rev. 06.16.2022

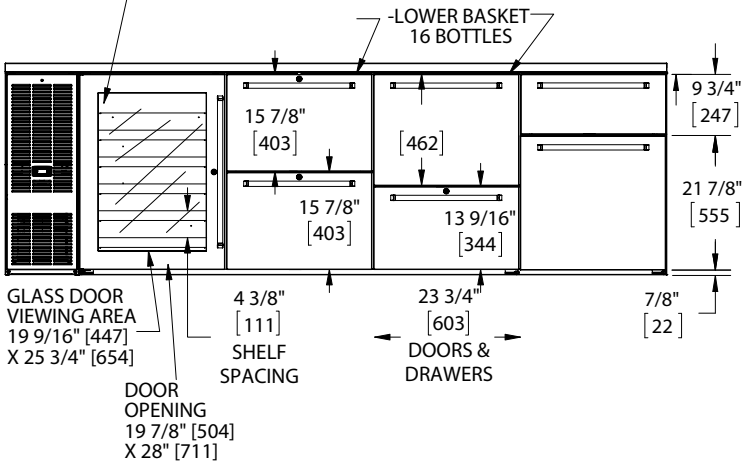
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PRODUCT SPECIFICATION SHEETS ▶ Refrigerated Cabinets

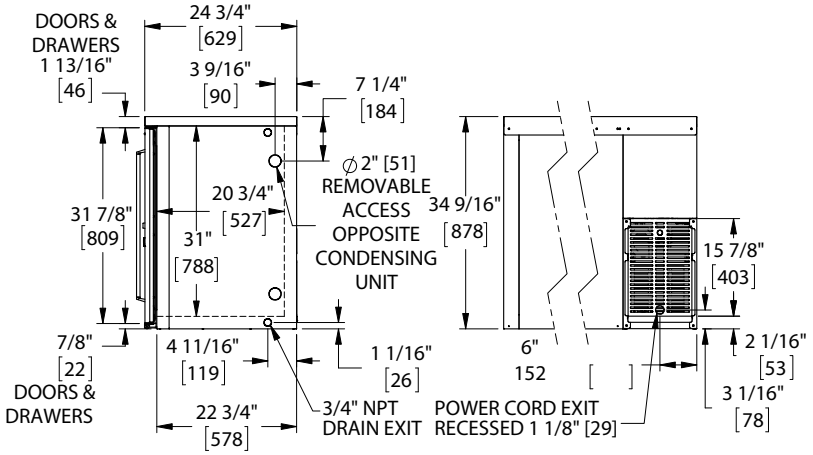
SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

Note: Open floor drain not provided on models intended for non-packaged food.
Maximum of 2 drawer compartments available on BBS84 and BBS108 models. Three drawer compartments shown only for dimensional purposes.





DRAWER DIMENSIONS		Refrigerator Drawer	Wine Drawer	Liquor Drawer
TOP BASKET	Length [mm]	17 1/8" [434]		
	Depth [mm]	20 1/16" [510]		
	Max Bottle Height [mm]	11 1/4" [285]	13 ½" [342]	4 ¾" [120]
BOTTOM BASKET	Length [mm]	17 1/8" [434]		
	Depth [mm]	20 1/16" [510]		
	Max Bottle Height [mm]	11 1/4" [285]	9 ¼" [234]	17 ¼" [438]



California Prop 65 Notice:

WARNING: The materials used in this product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm, For more information go to www.P65Warnings.ca.gov.

Form No. 95176
Rev. 06.16.2022

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PRODUCT SPECIFICATION SHEETS ▶ Refrigerated Cabinets

SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

NSF | c UL us | 5 Year Compressor Warranty | eco friendly R290 Hydrocarbon Refrigerant

JOB
AREA
ITEM NO.
MODEL NO.



BBS36 with optional glass w/stainless steel door shown



BBS36 with optional liquor drawers shown

Models	Description
BBS36	1-Door Model
BBS60	2-Door Model
BBS84	3-Door Model
BBS108	4-Door Model

KEY PRODUCT FEATURES AND BENEFITS

- Stainless steel interior & top standard on all perlick Back Bar refrigeration for long life durability and easy to clean hygienic storage
- 2" Foamed-in-place eco-friendly insulation provides energy savings with zero ozone depletion
- NSF/ANSI Standard 7 Listed for open food, beverage, and garnish storage
- End wall compressor & evaporator design increases storage capacity by 14% compared to top mounted designs
- Anti-Sweat heaters prevent condensation from forming, extending door gasket life and protecting flooring below from damage or slip hazards
- Multiple door and drawer styles available in any compartment:
    - Choose between Glass, Stainless-Steel, or Black Vinyl or Customer Provided Overlay
    - Choose between Refrigerator, Wine, or Liquor Drawers designed by Tobin Ellis

Quick Features

- Integrated door & drawer locks standard on all units
- Choose compressor mounted on left or right side of cabinet to match your space
- NSF Rated digital controller allows for easy and precise temperature changes
- Choose between three temperature ranges
    - Refrigerator (34°F-42°F) Factory set to 38°F
    - White Wine (40°F-65°F) Factory set to 45°F
    - Red Wine (40°F-65°F) Factory set to 60°F
- Choose between 6000K white LED lighting or cool blue display lighting
- 1 Year Parts and Labor Warranty, 5 Year Compressor Warranty
- Made in USA

Form No. 95176
Rev. 06.16.2022

PERLICK CORPORATION 8300 W. Good Hope Road, Milwaukee, WI 53223 • 800.558.5592 • perlick.com

SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

MODEL NUMBERS		BBS36	BBS60	BBS84	BBS108
NUMBER OF COMPARTMENTS/DOORS		1	2	3	4
EXTERIOR CABINET DIMENSIONS	Length - in. (mm)	36 (914)	60 (1524)	84 (2134)	108 (2743)
	Depth - in. (mm)	24¾ (629)	24¾ (629)	24¾ (629)	24¾ (629)
	Height - in. (mm)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)	34⁹⁄₁₆ (878)
INTERIOR CABINET DIMENSIONS	Length - in. (mm)	20 (508)	44 (1118)	68 (1727)	92 (2337)
	Depth - in. (mm)	18¾ (476)	18¾ (476)	18¾ (476)	18¾ (476)
	Height - in. (mm)	28½ (724)	28½ (724)	28½ (724)	28½ (724)
INTERNAL VOLUME Net. Cu. Ft. (Litres)		7.4 (210)	16 (453)	24.8 (702)	33.5 (949)
PRODUCT CAPACITY	CASE PACK - 12 OZ. BOTTLE/CAN	182/273	371/553	581/868	791/1183
	STAGGERED - 12 OZ. BOTTLE/CAN	196/292	400/592	628/932	856/1272
SHIPPING WEIGHT Lbs. (kg.)		254 (115)	340 (154k)	490 (222)	671 (304)
ELECTRICAL SPECIFICATIONS	Electrical Supply	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph	120 VAC/60 Hz/1 Ph
	Running Load Amps	1.8	2.5	4.2	4.2
	Electrical Connection	Cord connected	Cord connected	Cord connected	Cord connected
	Cord Plug Type	NEMA 5-15	NEMA 5-15	NEMA 5-15	NEMA 5-15
	Cord Length	6'5"	6'5"	6'5"	6'5"
	Defrost Initiation	Automatic	Automatic	Automatic	Automatic
	Defrost Type	Off cycle	Off cycle	Off cycle	Off cycle
	Thermostat	Digital control	Digital control	Digital control	Digital control
	Lighting Type	LED	LED	LED	LED
REFRIGERATION SPECIFICATIONS	Horsepower	1/6	1/5	1/4	1/4
	Refrigerant	R290	R290	R290	R290
	Refrigerant Charge (grams)	90	100	90	90
	Total Heat Rejection at 75F ambient (BTU/hr)	900	1900	2300	2300
	Factory Temperature Setting - Refrigerator F (C)	38° (3.3°)	38° (3.3°)	38° (3.3°)	38° (3.3°)
	Temperature Range - Refrigerator F (C)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)	33°-40° (0.5°-4.5°)
	Factory Temperature Setting - White Wine F (C)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)	50°-55° (10.0°-13.0°)
	Factory Temperature Setting - Red Wine F (C)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)	60°-65° (15.5°-18.0°)
	Temperature Range - Wine F (C)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)	50°-65° (10.0°-18.0°)
	Condensing Unit Location	Left or Right	Left or Right	Left or Right	Left or Right
	Expansion Device	Capillary tube	Capillary tube	Capillary tube	Capillary tube
	Pull-Out Condensing Unit	Yes	Yes	Yes	Yes
	Front Vented	Yes	Yes	Yes	Yes
PLUMBING		None required	None required	None required	None required

Note: *Wine Temperature refrigerators do not carry NSF Rating for open food storage. Wine Temperature units are NSF Certified for non-potentially hazardous bottled and canned beverage storage.*
Maximum of 2 drawer compartments can be selected for BBS84 and BBS108 models

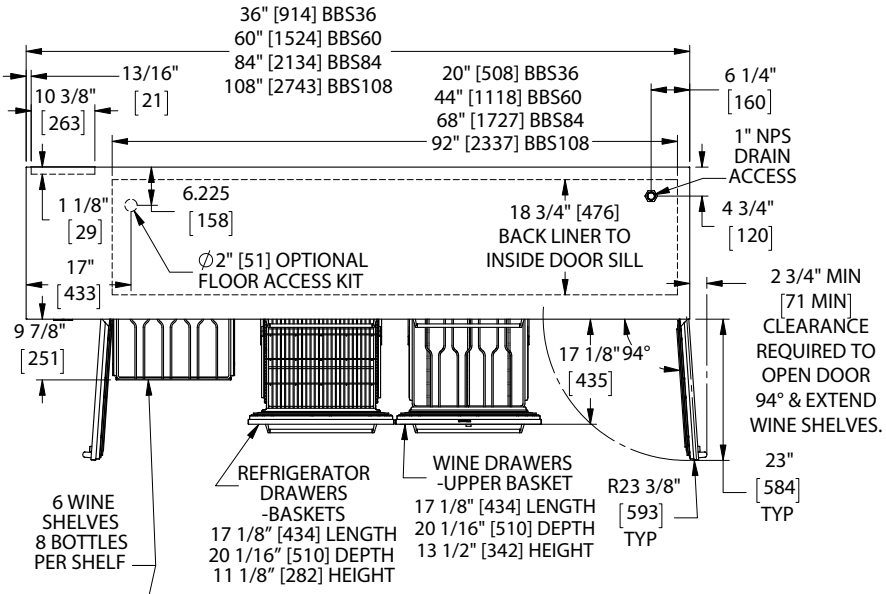
Form No. 95176
Rev. 06.16.2022

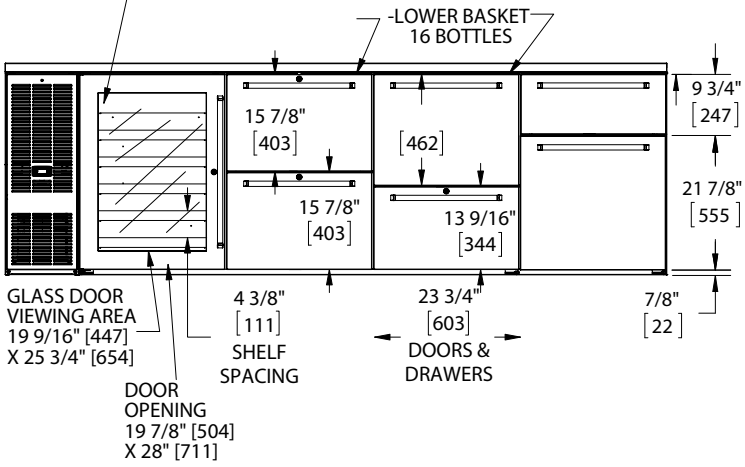
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PRODUCT SPECIFICATION SHEETS ▶ Refrigerated Cabinets

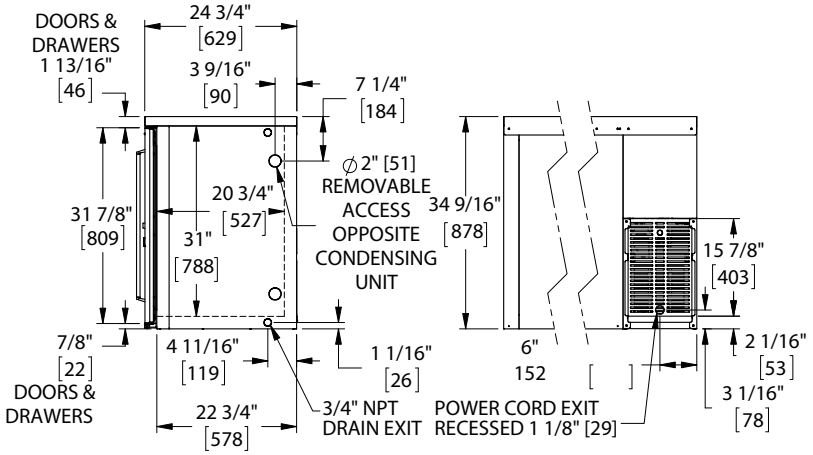
SELF-CONTAINED BACK BAR REFRIGERATOR
1-, 2-, 3- AND 4-DOOR

Note: Open floor drain not provided on models intended for non-packaged food.
Maximum of 2 drawer compartments available on BBS84 and BBS108 models. Three drawer compartments shown only for dimensional purposes.





DRAWER DIMENSIONS		Refrigerator Drawer	Wine Drawer	Liquor Drawer
TOP BASKET	Length [mm]	17 1/8" [434]		
	Depth [mm]	20 1/16" [510]		
	Max Bottle Height [mm]	11 1/4" [285]	13 ½" [342]	4 ¾" [120]
BOTTOM BASKET	Length [mm]	17 1/8" [434]		
	Depth [mm]	20 1/16" [510]		
	Max Bottle Height [mm]	11 1/4" [285]	9 ¼" [234]	17 ¼" [438]



California Prop 65 Notice:

WARNING: The materials used in this product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm, For more information go to www.P65Warnings.ca.gov.

Form No. 95176
Rev. 06.16.2022

PERLICK CORPORATION 8300 W. Good Hope Road, Milwaukee, WI 53223 • 800.558.5592 • perlick.com

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

JOB	
AREA	
ITEM NO.	
MODEL NO.	

MODELS
TS12DB
TS18DB
TS24DB
TS30DB
TS36DB
TS42DB
TS48DB

Other sizes available in 1" increments from 12" up to 30".



TS12DB



TS30DB

KEY PRODUCT FEATURES AND BENEFITS

- Drainboard tops are pitched to the drain, so water is evacuated quickly and effectively. With the matching insert, you still get a flat, level space to store your glassware.
- The default option of 'stadium' shaped perforated inserts enable great air flow for efficient glassware drying, maximize glass storage, and are designed to hold up to a busy bar environment abuse.
- Our new, more robust Perlick Quick Clamp leg attachment still features easy tool-less installation.
- All stainless construction with 18 gauge seamless stainless steel front apron for durability and cleanability.
- All Perlick drainboards are NSF-certified, so you can feel confident knowing your equipment will meet health code standards.

Additional Features:

- Optional Perlick Flex Mount leg relocation kit moves rear legs forward for additional space behind the equipment or moves forward legs rearward to help avoid pesky floor drains, available on TSF units.
- Swap out the perforated insert for a flat top insert when needs change and want to use the drainboard as a workspace Available on 12", 18", 24", 30".
- Stainless steel legs with adjustable thermoplastic feet install without tools for freestanding applications.

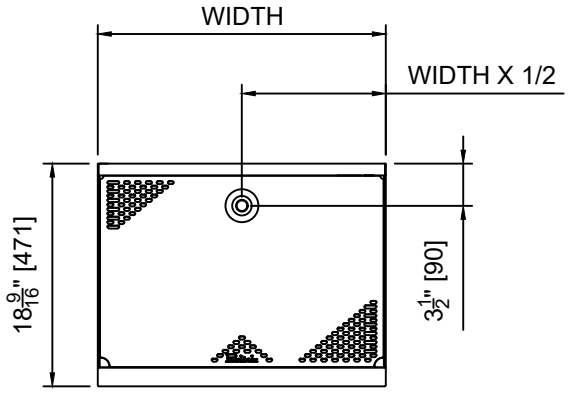
Form No. Z2958
Rev 11.29.23

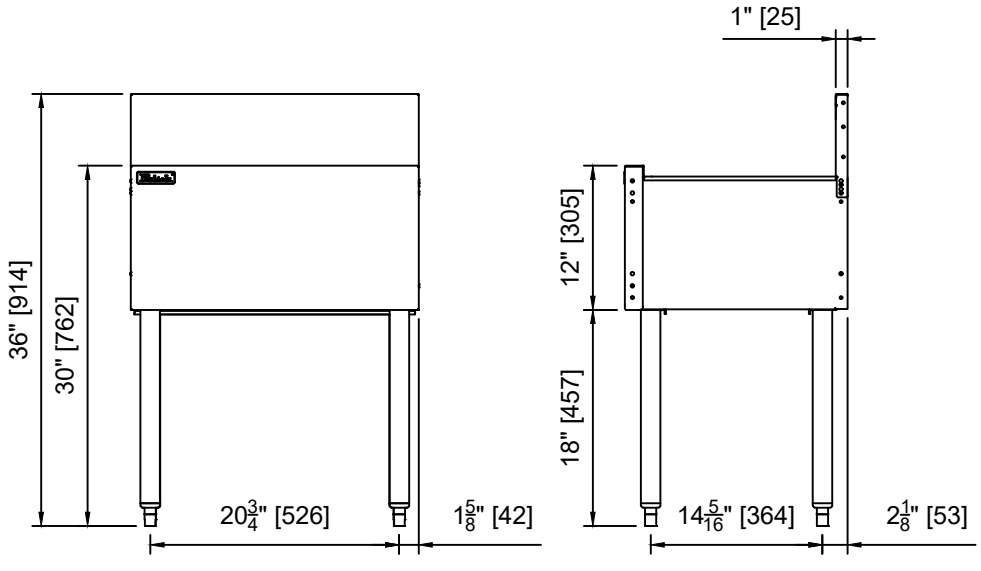
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TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D

MODEL NOS.		TS12DB	TS18DB	TS24DB	TS30DB	TS36DB	TS42DB	TS48DB
DIMENSIONS: EXTERIOR	Width In. (mm)	12" (305)	18" (457)	24" (610)	30" (914)	36" (914)	42" (1067)	48" (1219)
	Depth In. (mm)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)	18-9/16" (471)
	Weight lb. (kg)	35 (16)	40 (18)	45 (20)	50 (23)	60 (27)	90 (41)	115 (52)
MATERIALS	Construction	All stainless steel						
	Front & Back	Seamless 18 gauge stainless steel						
	Backsplash	6" or 4" high stainless steel with 1" return, fastened and sealed.						
	Drainboard	Pitched stainless steel drainboard top, All horizontal and vertical edges 1/4" radius with balled corners.						
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot						
MECHANICALS	Plumbing	Stainless steel drain socket located back center of the equipment. Drain connection is 1-1/2" NPS male.						
OPTIONAL ACCESSORIES (PARTIAL LIST)		Perforated insert(s), flat top insert(s), speed rails, bottle opener, end splashes, backsplash cutout						

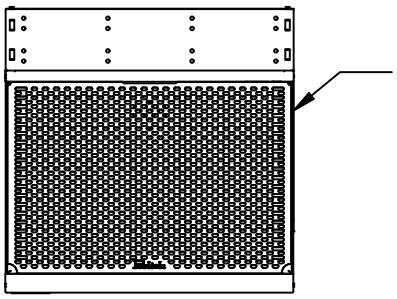




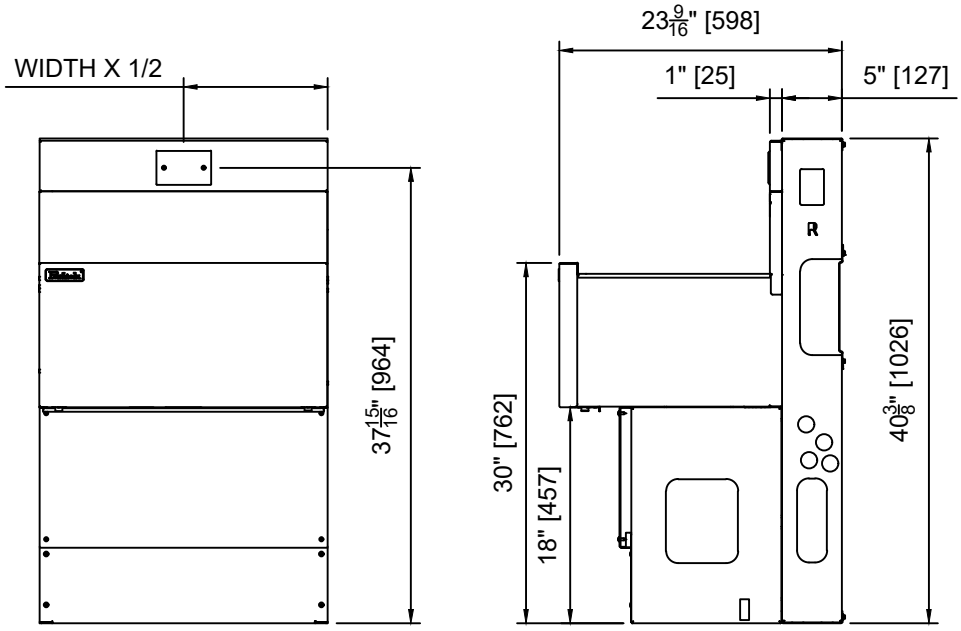
Form No. Z2958
Rev 11.29.23

TOP SHELF DRAINBOARDS

TS Series - 12" - 48"W X 18-9/16"D



SHOWN WITH FULL
DRAINBOARD INSERT



ONE TANK SINKS – STAINLESS STEEL BOWL

MODELS
TS Series
□ TS12HS

MODELS
TSD Series
□ TSD12HS



Perlick Features

- Deep drawn stainless steel bowl
- NSF listed, commercial grade hot/cold water faucet (must be ordered separately)
- Underside is sound-deadened
- Stainless steel legs install without tools and have "Rust Free" thermoplastic feet

GENERATIONS OF EXCELLENCE

Form No. SK02
Rev. 09.19.2011

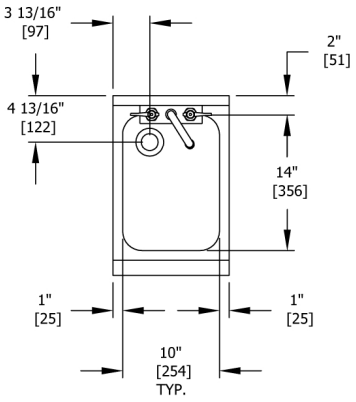
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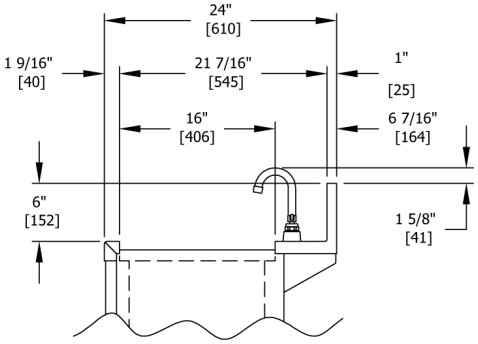
Size and Specifications

One Tank Sink – Stainless Steel Bowl

Job _____
Area _____
Item No. _____
Model No. _____

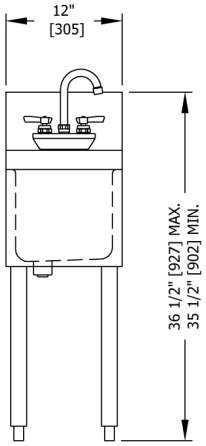
MODEL NO.	TS12HS	TSD12HS
LENGTH IN. (mm)	12" (305)	12" (305)
SHIP WEIGHT LB. (kg)	45 (20)	45 (20)
TOP & SIDES	Stainless steel	
BACK & BOTTOM	Stainless steel	
BACKSPLASH	Stainless steel 6" high (4" high optional) with 1" return at the top, mechanically fastened and sealed to hand sink top with steel support brackets. **TSD Series:** Stainless steel rear deck	
LEGS	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot.	
BOWL	Stainless steel with sound deadening. 10"x14"x9-1/4" deep. All horizontal and vertical edges 1-1/2" radius with balled corners. Furnished with 1-1/2" stainless steel drain socket. 8-1/2" standpipe.	
WATER FAUCET	Chrome plated, hot and cold, goose neck swing spout faucet. Heavy-duty all brass construction. ***Must be ordered separately.*** Lead free faucet also available.	
PLUMBING	Drain connection: 1-1/2" NPS male. Hot and cold water connection, 3/8" copper supply tubes	Drain connection: 1-1/2" NPS male. Hot and cold water connection, 1/2" IPS shanks and nuts

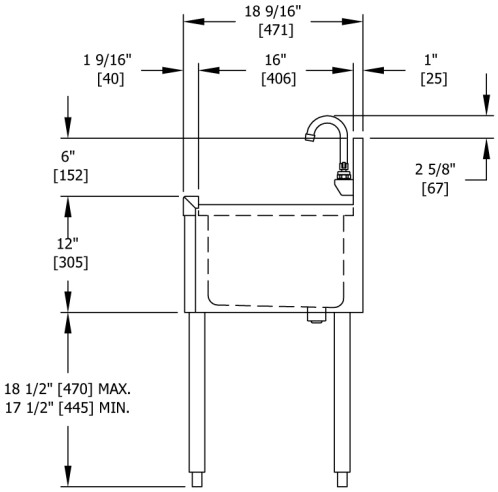




TSD END VIEW

**Faucet shown for clarity;*
must be ordered separately





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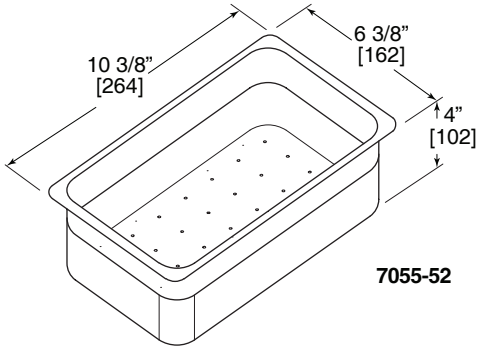
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UNDERBAR ACCESSORIES
BLENDERS AND SINKS

Job _____
Area _____
Item No. _____
Model No. _____

WET WASTE BOX- PERFORATED

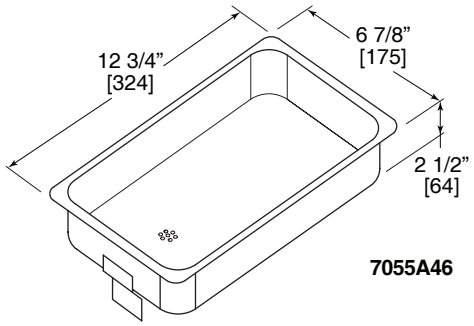
PART NO.	7055-52
APPLICATION	Perforated pan allows liquid to drain from wet waste into 12" and 14" stainless steel Blender Station bowls. Not applicable on full size stainless steel sinks.
MATERIAL	¼ size clear polycarbonate pan (2.7 quart) with 1/8" diameter holes in bottom.



7055-52

WET WASTE BOX- WITH DRAIN TUBE

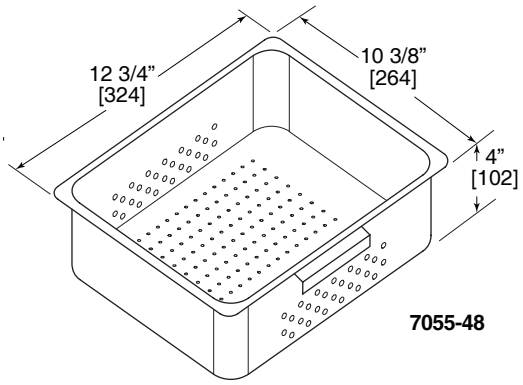
PART NO.	7055A46
APPLICATION	TS Series: Drains into standpipe on three and four tank sinks. **NOTE**: Use on sinks bowls without faucet (faucet body interferes with Wet Waste Box). TSD Series: Drains into standpipe on one, two, three and four tank sinks.
MATERIAL	1/3 size stainless steel pan (2.25 quart) with integral strainer and ¾" diameter x 2 3/8" long drain tube.



7055A46

WET WASTE BOX- PERFORATED

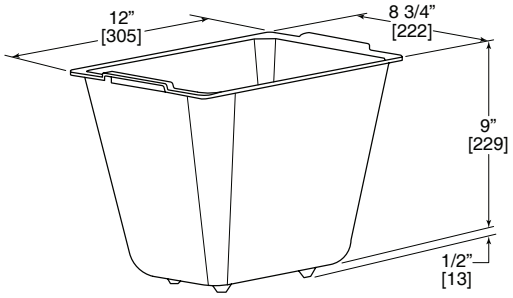
PART NO.	7055-48
APPLICATION	Perforated pan allows liquid to drain from wet waste into any sink with full size stainless steel bowl. Not applicable on 12" and 14" blenders.
MATERIAL	½ size stainless steel pan (7 quart) with 1/8" diameter holes in bottom and ¼" diameter holes on two sides.



7055-48

WET WASTE BOX - PERFORATED (UNIVERSAL)

PART NO.	UAC - WWB
APPLICATION	Perforated pan allows liquid to drain from wet waste into any sink with full size stainless steel bowl. Not applicable on 12" and 14" blenders.
MATERIAL	Black ABS (11 quart) with 3/16" diameter holes in bottom.



UAC-WWB

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UNDERBAR ACCESSORIES
BLENDERS AND SINKS

Job _____
Area _____
Item No. _____
Model No. _____

ELECTRONIC "TOUCH-FREE" FAUCET ADAPTER

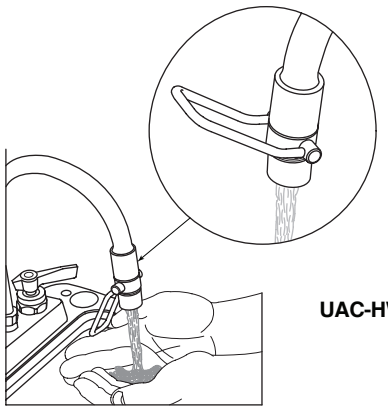
PART NO.	UAC-EFA
APPLICATION	Converts most faucets into an automatic "Touch-Free" faucet. Simply remove the faucet aerator and install the adapter to end of spout with a simple screw-on installation.
FLOW RATE	2.2 GPM Aerator. Infrared sensor stops water flow automatically. 3-minute automatic time-out feature minimizes chance of overflow. Manual on/off over-ride button provides constant flow to fill sink or containers.
WATER TEMP.	Manually set the faucet handles to desired temperature.
POWER SUPPLY	(4) AAA Batteries (not included). Low battery indicator.
SENSOR RANGE	2"- 10" (5- 25cm) based on sink type and illumination.
WORKING PRESSURE	10-125 psi



UAC-EFA

AUTOMATIC FAUCET CONTROLLER

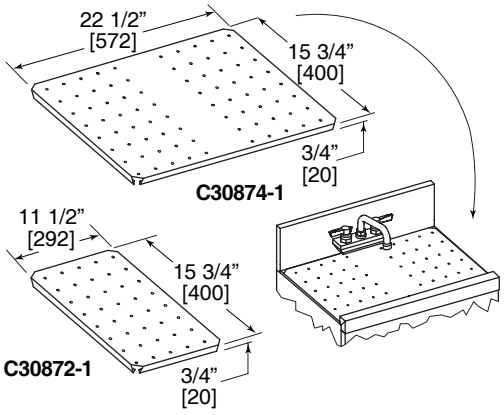
PART NO.	UAC-HWFC
APPLICATION	Converts any faucet to "Hands-Free". Simply remove the faucet aerator and install controller to end of spout (supplied with universal adapters).
FLOW RATE WATER TEMP	Manually set the faucet handles to desired water flow and temperature.
MATERIALS	Brass and stainless steel with an anti-microbial coated lever
OPERATION	Automatic self-closing "Hands-Free" full on position



UAC-HWFC

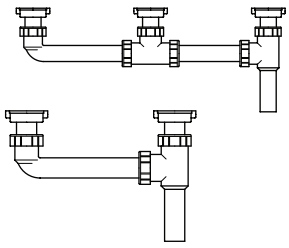
PERFORATED COVER-STAINLESS STEEL

APPLICATION	PART NO.
Converts complete bowl opening on TS12HS to a Drainboard.	C30872-1
Converts complete two bowl opening on TS22C to a Drainboard.	C30874-1



DRAİN ASSEMBLES-PVC

APPLICATION	PART NO.
Sinks with two stainless steel bowls (ex.TS22C)	202PVC
Sinks with three stainless steel bowls (ex. TS33C)	26482PVC
Sinks with four stainless steel bowls (ex. TS44C)	26843PVC



26482PVC

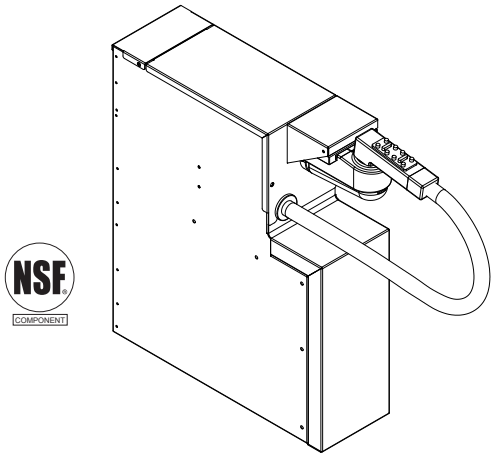
202PVC

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Form No. ACC-02
Rev. 04.23.10

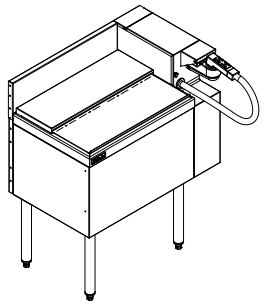
SODA GUN FILLER SECTIONS
TS AND TSF SERIES



JOB	
AREA	
ITEM NO.	
MODEL NO.	

TS4SGB	TS Series Model
TS6SGB	TS Series Model
TSF4SGB	TSF Series Model
TSF6SGB	TSF Series Model

Standard 6″ Backsplash Height



Shown attached to TS24IC10

Note: Soda manifold, hose gun and drip cup NOT included. Shown for clarity of use only.

Features

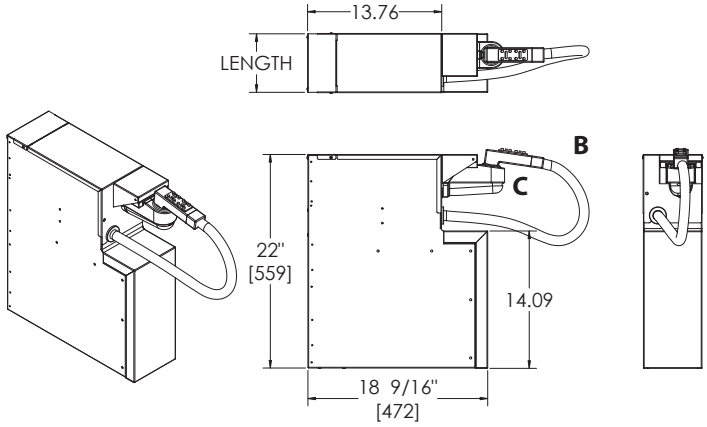
- All stainless steel construction
- Universal design accepts either Wunder-Bar® and Schroeder America™ 8-14 product soda manifolds and drip cups
- Interior mounted manifold conceals unsightly soda lines
- Tool-less removal of Top Cover provides easy service access
- Integrated drip cup mounting allows conceled routing of drip tube to waste drain
- Accessory Speed Rails can by-pass or terminate on Soda Gun Filler
- Speed rails can cross or terminate on soda gun filler.

PRODUCT SPECIFICATION SHEETS ▶ Underbar Soda Gun Filler Sections

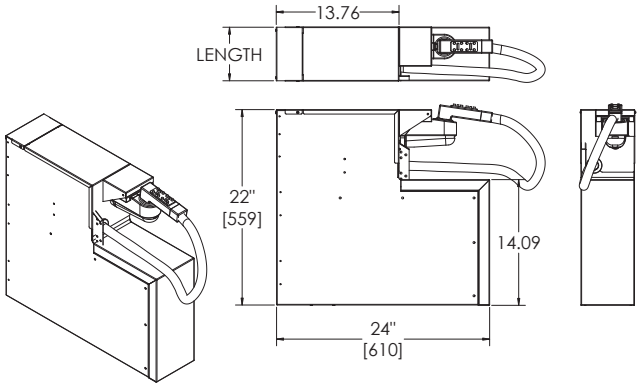
SODA GUN FILLER SECTIONS
TS AND TSF SERIES

Specifications

MODEL NOS.	TS4SGB*	TSF4SGB*	TS6SGB	TSF6SGB
LENGTH IN. (mm)	4" (102)	4" (102)	6" (152)	6" (152)
DEPTH IN. (mm)	18-9/16" (472)	24" (610)	18-9/16" (472)	24" (610)
SHIP WT. LB. (kg)	18 (8.16)	18 (8.16)	18 (8.16)	18 (8.16)
CONSTRUCTION	Stainless Steel			
LEGS	Not applicable, must be mounted to adjacent equipment.			
CAPACITY/APPLICATION	Universal Mounting Brackets accepts "non-flow-control" 8-14 product manifolds from Wunder-Bar® or Schroeder America™ that don't exceed 3" in overall thickness.		Universal Mounting Brackets accepts 8-14 product manifolds from Wunder-Bar® or Schroeder America™	

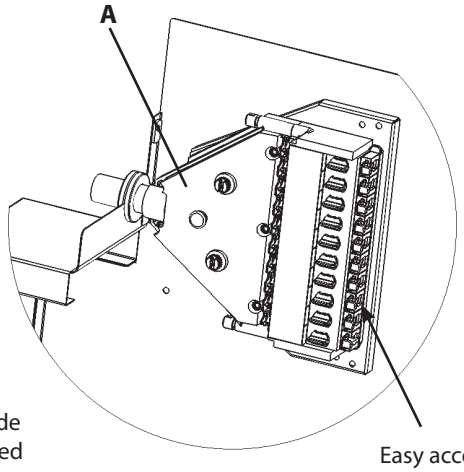


TS6SGB



TSF6SGB

Soda A) manifold; B) hose gun; and C) drip cup NOT included. Shown for clarity only.



Once assembled, soda lines are out of view (side and cover panel removed for clarity)

Easy access to product line connections

Form No. FS03
Rev. 05.11.2016

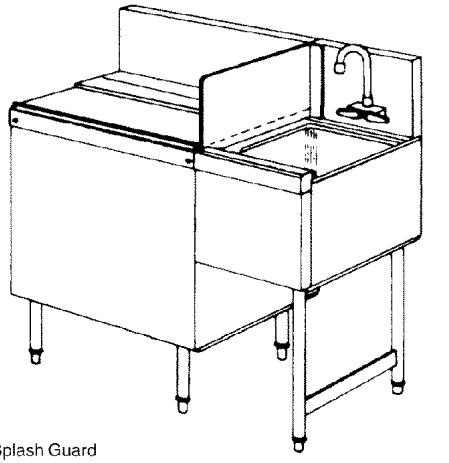
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Splashguards

Stainless steel. Factory installed between individual Topshelf modules or added to either end.

Part No.	For Model No.	Length	Height
7054L	Left endsplash for TS series	18"	8"
7054R	Right endsplash for TS series	18"	8"
7054	Between modules for TS series	18⅝"	8"
7054DL	Left endsplash for TSD series	24"	8"
7054DR	Right endsplash for TSD series	24"	8"
7054D	Between modules for TS series	24⅝"	8"
7054SL	Left endsplash for TSs series	38"	8"
7054SR	Right endsplash for TSS series	38"	8"

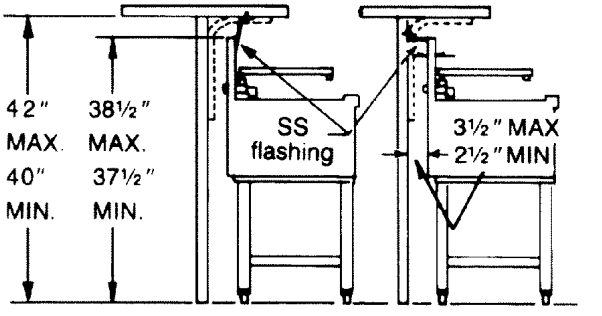


No. 7054 Splash Guard between two workboard modules

STAINLESS STEEL UNDERBAR FLASHING

Used to seal underbar service area to underside of bar. Also used to bridge the gap between the bar die and backsplash or the underbar and backsplash. Available in ten foot lengths which are easily formed in the field to match the bar die. Predrilled holes to facilitate installation.

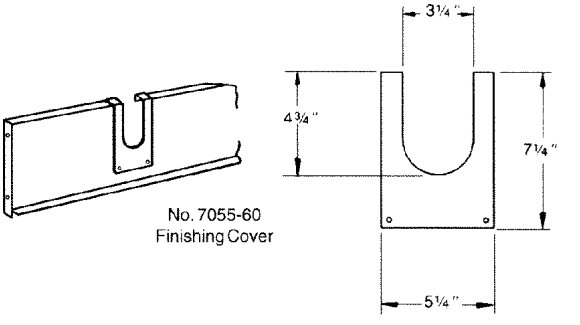
Part No.	Description
C31682	First ten feet - 4½" wide
C31683	Additional ten foot lengths - 4½" wide



No. C31682
Stainless Steel Flashing

ACCESS CUTOUT FINISHING COVER for Trunk Housing

Part No.	Description
7055-60	Finishing cover



No. 7055-60
Finishing Cover

CONNECTOR KITS

One required for each joint.

Part No.	Description
7055-45*	For modules with 8" backsplash
7055-4-45*	For modules with 4" backsplash
7055-53	For end mount in lieu of leg

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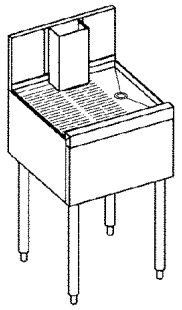
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Access Cutout with Chase for TS Series Drainboards

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-69	For 8" backsplash	3"	5"
7055-69-4	For 4" backsplash	3"	5"



Drainboard with No. 7055-69 Cutout

Backsplash Cutout for Soda Lines

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-265	Backsplash cutout for soda lines	6"	4"

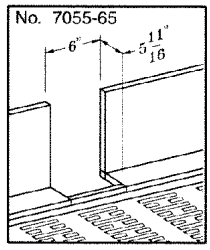
ACCESS CUTOUT FINISHING COVER for Trunk Housing

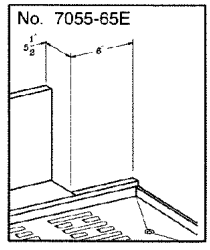
Part No.	Description
7055-60	Finishing cover

ACCESS CUTOUT without Chase for TSD Series Workboards

Provides a 6" x 5¾" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-65E	Cutout at either end (specify location)
7055-65	Cutout 6" increments from either end (specify location)

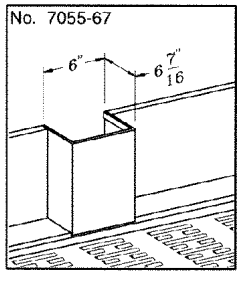


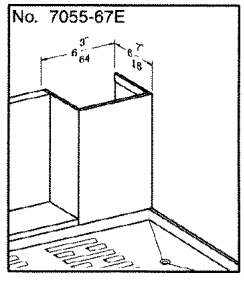


ACCESS CUTOUT with Chase for TSD Series Workboards

Provides a 6" x 6½" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-67E	Cutout at either end (specify location)
7055-67	Cutout 6" increments from either end (specify location)





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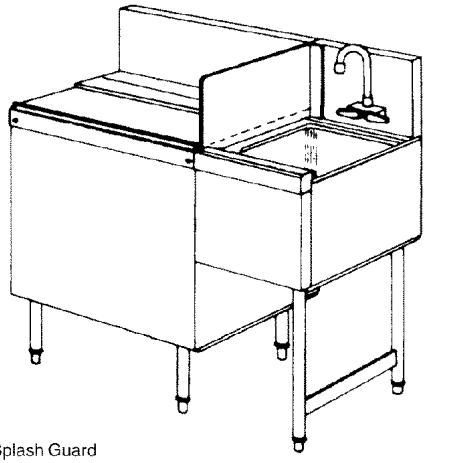
Item No. _____
Model No. _____
Job _____
Area _____

Miscellaneous Accessories

Splashguards

Stainless steel. Factory installed between individual Topshelf modules or added to either end.

Part No.	For Model No.	Length	Height
7054L	Left endsplash for TS series	18"	8"
7054R	Right endsplash for TS series	18"	8"
7054	Between modules for TS series	18 5/8"	8"
7054DL	Left endsplash for TSD series	24"	8"
7054DR	Right endsplash for TSD series	24"	8"
7054D	Between modules for TS series	24 5/8"	8"
7054SL	Left endsplash for TSs series	38"	8"
7054SR	Right endsplash for TSS series	38"	8"

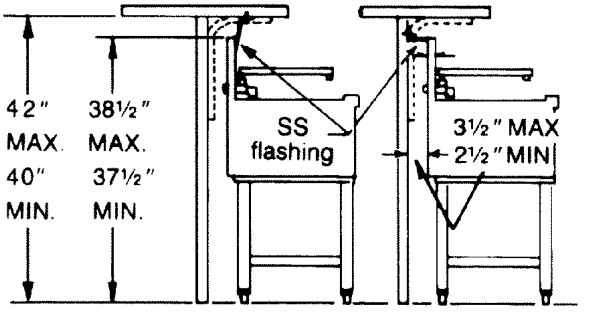


No. 7054 Splash Guard between two workboard modules

STAINLESS STEEL UNDERBAR FLASHING

Used to seal underbar service area to underside of bar. Also used to bridge the gap between the bar die and backsplash or the underbar and backsplash. Available in ten foot lengths which are easily formed in the field to match the bar die. Predrilled holes to facilitate installation.

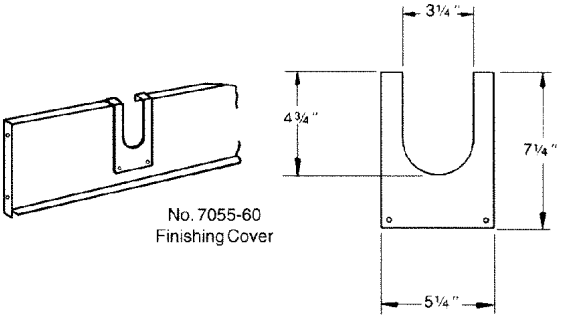
Part No.	Description
C31682	First ten feet - 4 1/2" wide
C31683	Additional ten foot lengths - 4 1/2" wide



No. C31682
Stainless Steel Flashing

ACCESS CUTOUT FINISHING COVER for Trunk Housing

Part No.	Description
7055-60	Finishing cover



No. 7055-60
Finishing Cover

CONNECTOR KITS

One required for each joint.

Part No.	Description
7055-45*	For modules with 8" backsplash
7055-4-45*	For modules with 4" backsplash
7055-53	For end mount in lieu of leg

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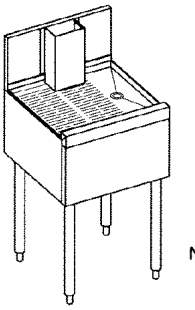
Item No._____
Model No._____
Job _____
Area_____

Miscellaneous Accessories

Access Cutout with Chase for TS Series Drainboards

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-69	For 8" backsplash	3"	5"
7055-69-4	For 4" backsplash	3"	5"



Drainboard with No. 7055-69 Cutout

Backsplash Cutout for Soda Lines

Stainless steel. Includes chimeny. Factory-installed. Does not alter backsplash

Part No.	For Model No.	Length	Height
7055-265	Backsplash cutout for soda lines	6"	4"

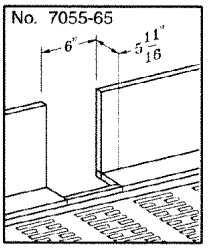
ACCESS CUTOUT FINISHING COVER for Trunk Housing

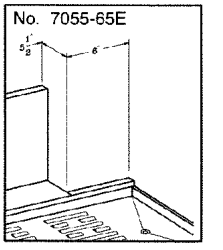
Part No.	Description
7055-60	Finishing cover

ACCESS CUTOUT without Chase for TSD Series Workboards

Provides a 6" x 5¾" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-65E	Cutout at either end (specify location)
7055-65	Cutout 6" increments from either end (specify location)

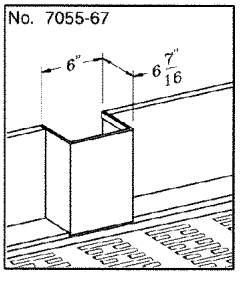


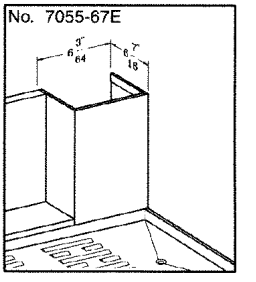


ACCESS CUTOUT with Chase for TSD Series Workboards

Provides a 6" x 6½" opening for beverage and/or electrical lines. Factory installed.

Part No.	Description
7055-67E	Cutout at either end (specify location)
7055-67	Cutout 6" increments from either end (specify location)





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UNDERBAR ICE CHESTS

TS Series Ice Chests

JOB	
AREA	
ITEM NO.	
MODEL NO.	



TS24IC10

MODELS	
Cold Plate	**Non-Cold Plate**
	TS18IC
TS24IC10	TS24IC
TS30IC10	TS30IC
TS36IC10	TS36IC
TS42IC10	TS42IC
TS48IC10	TS48IC

KEY PRODUCT FEATURES AND BENEFITS

- All stainless for durable easy to clean surfaces
- Fully insulated to reduce ice melt in warm climates
- Highly efficient cold plates instantly chill your soft drinks to the correct temperature
- Eco-friendly foam insulation is efficient and has zero impact on global warming or ozone depletion
- Stainless steel legs with adjustable thermoplastic feet are strong and install easily without tools
- Available with or without a cold plate to suit your bartender's needs

Quick Features:

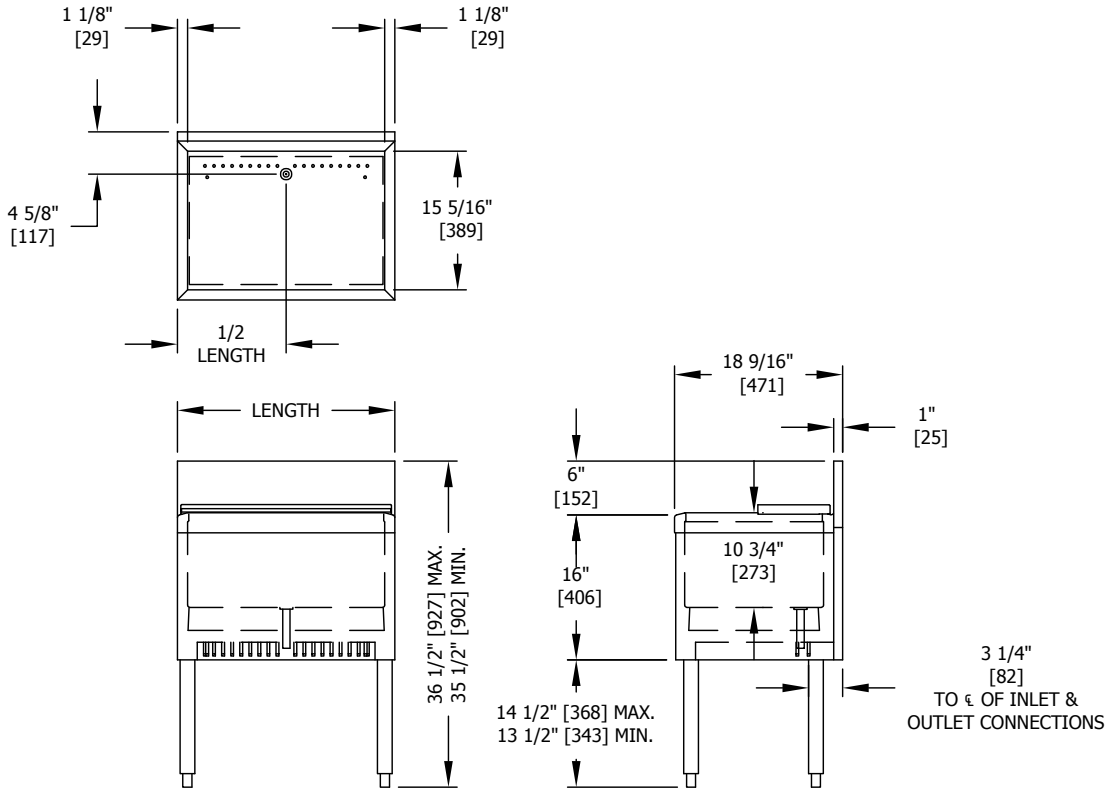
- Fully insulated with highly efficient eco-friendly polyurethane foam
- Built with stainless steel to maximize the lifespan
- Boldly innovative cold plate design increases thermo efficiency to instantly chill your soft drink to the right temperature

UNDERBAR ICE CHESTS

TS Series Ice Chests

MODEL NOS.							
MODEL TYPE:	Non-Cold Plate Models	**TS18IC**	**TS24IC**	**TS30IC**	**TS36IC**	**TS42IC**	**TS48IC**
	Cold Plate Models	**NA**	**TS24IC10**	**TS30IC10**	**TS36IC10**	**TS42IC10**	**TS48IC10**
DIMENSIONS: EXTERIOR (mm)	Length, Inches (mm)	18 (457)	24 (610)	30 (762)	36 (914)	42 (1067)	48 (1219)
	Ice Capacity, lbs. (kg)	60 (27.2)	80 (36.3)	100 (45.4)	125 (56.7)	145 (65.8)	165 (74.8)
	Ship Weight with cold plate lb/kg	NA	81 (36.5)	86 (39)	92 (41.5)	98 (44.4)	103 (46.7)
	Ship Weight without cold plate lb/kg	28 (12.7)	34 (15.3)	38 (17.2)	45 (20.3)	50 (22.7)	55 (25.1)
MATERIALS	Front & Sides	Stainless Steel					
	Backsplash	Stainless steel, 6" high, (4" optional), with 1" return at top, mechanically fastened and sealed to ice chest top with steel support brackets					
	Back & Bottom	Galvanized steel					
	Interior	Stainless steel with 1/4" Radius corners, welded, polished, and sealed with non-exposed cold plate. Interiors can be divided with accessory freestanding ice bin dividers.					
	Insulation	Eco-friendly foamed-in-place polyurethane					
	Legs	1-5/8" tubular, stainless steel with 1" adjustable thermoplastic foot					
	Top Rim	ABS					
MECHANICALS	Plumbing	Drain connection– 1-1/2" NPS male					
	Cold Plate	Cast aluminum plate concealed under ice chest liner. Cold plate has 2 full-length circuits and 8 half length circuits. **Connections** – 5/16" O.D. stainless steel tubing with swaged end to accept standard 1/4" I.D. beverage tubing					
OPERATING SPECIFICATIONS	Cold Plate	Each full circuit will deliver four 6 oz. drinks per minute at 40° continuously, or 40 oz. every three minutes in a single draw (flow rate 2 oz./sec, 75° product)					
MISCELLANEOUS	Accessories *(Ordered separately)*	Covers, ice bin dividers, condiment trays with cups, speed rails, blender shelves, bottle opener, towel rings, side splashes, soda gun filler section					

Note: Covers not included.



TS END VIEW

Form No. Z2810
Rev 03.25.22