SPECIFICATIONS FOR:

DUCHESNE HIGH SCHOOL PHASE III

PROJECT ADDRESS:

155 W Main Street
Duchesne, UT 84021

OWNER: Duchesne County School District
1010 E 200 N
Roosevelt , Utah 84066

ARCHITECT: KMA Architects
170 N Main Street
Spanish Fork, UT 84660

PROJECT DIRECTORY
Duchesne County School District – Duchesne High School Phase III

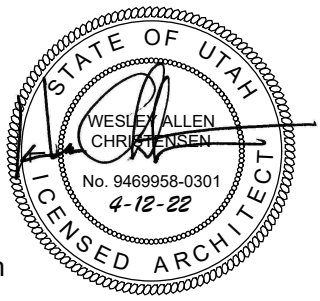
OWNER
Duchesne County School District
1010 E 200 N
Roosevelt , Utah 84066
(435) 725-4500

Contacts:
Dee Miles
dmiles@dcsd.org
Michael Weldon
mweldon@dcsd.org

FIRE MARSHAL
State Fire Marshal Office
5272 S. College Dr., Suite #302
Murray, Utah 84123
(801) 284-6350
(801) 284-6351 - Fax

Contact:
Ryan Putman
rputman@utah.gov

ARCHITECT
KMA Architects
170 N Main Street
Spanish Fork, UT 84660
(801) 377-5062



Contact:
Wes Christensen
wes@kmaarchitects.com
Rob White
robw@kmaarchitects.com

GENERAL CONTRACTOR
Westland Construction
1411 West 1250 South, Suite #200
Orem, Utah 84058
(801) 374-6085

Contact:
Mark Petersen
mark@westlandconstruction.com

LANDSCAPE DESIGN
KMA Architects
170 N Main Street
Spanish Fork, UT 84660
(801) 377-5062

Contact:
Rob White
robw@kmaarchitects.com

CIVIL ENGINEER
Great Basin Engineering
5746 South 1475 East
Ogden, UT 84403
(801) 394-4515

Contact:
Mark Babbitt
markb@greatbasineng.com

STRUCTURAL ENGINEER
Dynamic Structures
1887 North 1120 West
Provo, Utah 84604
(801) 536-1140

Contact:
Jay Adams
jay@dstructures.com

MECHANICAL ENGINEER
Olsen and Peterson Consulting Engineers
14 East 2700 South
Salt Lake City, Utah 84115
(801) 486-4646

Contact:
Mitch Tervort
mitch@op-eng.com

ELECTRICAL ENGINEER
Royal Engineering
1837 S East Bay Blvd
Provo, Utah 84606
(801) 375-2228

Contact:
David Wood
dave.wood@royaleng.com

Note to Contractors:

All contractors, subcontractors, and suppliers shall bid the following construction documents including all plans, specifications, and addenda in their entirety. Items pertaining to all trades can be found throughout these construction documents and shall be bid as such.

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07 41 13 METAL ROOF PANELS

07 42 13 METAL WALL PANELS

07 54 00 PVC MEMBRANE ROOFING

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07 72 00 ROOF ACCESSORIES

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33 11 00 WATER UTILITY PIPING

33 31 00 SANITARY SEWER

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NOTICE TO CONTRACTORS

Duchesne High School & Sports Complex
155 West Main Street Duchesne, UT 84021

Westland Construction, Inc., as Construction Manager for **Duchesne County School District**, is requesting labor and material bids for the construction of the **Duchesne High School & Sports Complex** in accordance with plans, specifications and bid documents as prepared by KMA Architects.

Proposals will be received on or before **Tuesday, April 26th @ 2 pm** prevailing Mountain Time at the offices of Westland Construction, Inc. (Email & Fax Number listed below). **All proposals must be submitted on the provided Bid Form found in the project manual.**

A pre-bid meeting will be held onsite in the Library **Thursday, April 14th at 10am**. This meeting is for all subcontractors interested in bidding the project. This will be the only time to review onsite existing conditions**.**

Questions on scope of work, trade coordination and bidding should be directed to **John Sheldon, Mark Petersen, and Austin Kerr** at Westland Construction and **Rob White** at KMA Architects.

Westland Construction, Inc.
1411 West 1250 South Suite 200
Orem, Utah 84058
Phone: 801-374-6085
Fax: 801-374-6060
jsheldon@westlandconstruction.com
www.westlandconstruction.com

KMA Architects
170 North Main Street
Spanish Fork, Utah 84660
Phone: 801-372-5062
robw@kmaarchitects.com
www.kmaarchitects.com

A 5% BID SECURITY MUST BE ATTACHED FOR BIDS OVER $100,000. PLEASE SUBMIT COPY OF BID SECURITY VIA FAX OR EMAIL. Bid Security may be a bid bond made payable to the order of Westland Construction, Inc. The bid security of the accepted bidder shall be forfeited in the case of failure or refusal to enter into a contract and furnish payment and performance bonds as may be required.

Time is of the essence on this project. Refer to the Bid Documents for specific schedule and liquidated damage requirements.

Inasmuch as the Owner is a political subdivision of the State of Utah, all trades on the project must certify by affidavit, prior to commencing any work on the project, that they participate in a **Status Verification System** to verify the work eligibility status of its new employees in accordance with Section 63G-11-103 Utah Code Annotated.

Any award or rejection, in whole or in part, relating to this project is contingent upon budget restraints. Refer to the Bid Documents for Proposal Guidelines.

The Owner and Construction Manager reserve the right to accept or reject any and all proposals or alternates with or without cause for any reason determined in its sole subjective determination to be in the Owner's best interest and to waive any informality in bidding.

Proposals shall be properly executed upon the Bid Form with all items filled out. The completed form shall be without deletions, alterations, or erasures. Proposal forms are available at the office of the construction manager and in the specification manual.

Before submitting a proposal, bidders shall carefully examine the plans, read the project manual, all addenda, and all other bid documents. They shall visit the site of work and shall fully inform themselves as to all existing conditions and limitations. They shall include in the proposal a sum to cover the cost of all items included in the bid documents and within the time frame stated in the bid documents.

Securing Documents: Plans and project manual will be available to interested parties no earlier than April 12th, 2022. Plans can be viewed online at www.westlandconstruction.com. **Contact Charity Lindstrom @ 801-374-6085 or clindstrom@westlandconstruction.com** to make arrangements to receive bidding documents.

Contractor's Qualification Statement: Any bidder shall, upon request, submit a Contractor's Qualification Statement, AIA Document A305. Failure to show a statement satisfactory to the Owner will be reason to reject the proposal as non-responsive.

BID FORM
DUCHESNE HIGH SCHOOL & SPORTS COMPLEX
155 WEST MAIN STREET DUCHESNE, UTAH 84021

Name of Bidder:_____ Date: _____
Address:_____ City/Zip:_____
Contact Person:_____ Email:_____
Phone:_____ Fax:_____

Bid to: Westland Construction, Inc.
1411 West 1250 South, Ste 200
Orem, UT 84058
Telephone: (801) 374-6085 Fax: (801) 374-6060
Email bids to bids@westlandconstruction.com

Addenda: I/We acknowledge receipt of the following addenda:**__/__/__/__/.**

THIS PUBLIC SCHOOL PROJECT IS SALES TAX EXEMPT; DO NOT INCLUDE SALES TAX IN YOUR BID!
Note: All materials purchased for this project are tax exempt and subject to Form TC-721 Exemption Certificate, to be filed with each vendor.

Specification Sections Bidding**:**

Division / Section(s) & Description	Installed?	Bid Amount
_____	_____	$_____
_____	_____	$_____
_____	_____	$_____

High School Base Bid:_____

Dollars ($_____)
(In the case of discrepancy, written amount shall govern)

Division / Section(s) & Description	Installed?	Bid Amount
_____	_____	$_____
_____	_____	$_____
_____	_____	$_____

Breakout Baseball Field Cost:_____

Dollars ($_____)
(In the case of discrepancy, written amount shall govern)

Alternate Lighting Package

_____

A. SCHEDULE OF ALTERNATES

Alternate #1 – Football Field Scope of Work (see specifications)

_____

B. ADDITIONAL BIDDING REQUIREMENTS: (Failure to respond where required may result in disqualification of the bid).

1. Bids shall be priced lump sum to furnish and/or install all material and/or equipment as required by plans and specifications. A 5% BID SECURITY MUST BE ATTACHED FOR BIDS OVER $100,000. **PLEASE SUBMIT COPY OF BID SECURITY VIA FAX OR EMAIL.** Bid Security may be a bid bond made payable to the order of Westland Construction, Inc. The bid security of the accepted bidder shall be forfeited in the case of failure or refusal to enter into a contract and furnish payment and performance bonds as may be required.

2. Westland Construction, as Construction Manager for Nebo School District reserves the right to accept or reject any and all proposals or alternates with or without cause for any reason determined by it or the District to be in the District's best interest and to waive any bidding informality.

3. Liquidated Damages for the project will be the following:

Days of Delay	Liquidated Damages per Day
0 to 15	$500.00
15 to 30	$1,000.00
30 to 45	$1,500.00
45 or more	$3,000.00

4. Proposed Project Foreman/Salesman:_____

   Contact Phone: _____Contact Email:_____

5. List All Long - Lead Items that may possibly affect the overall schedule time.

   - _____
   - _____
   - _____

6. Have reviewed and agree to construction schedule.
   Yes_____ No_____

7. Have confirmed all product or subcontractors are approved
   Yes_____ No_____

8. The undersigned, having examined the Drawings, Specifications and related documents in their entirety, and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of labor, hereby propose to complete the work listed above in accordance with the Contract Documents and within the time set forth, at the price stated above and upon the subcontract form included in the Bid Documents. The

above price is to cover all expenses incurred in performing the work required under the Contract Documents of which this proposal is a part.

9. CONTRACTOR'S QUALIFICATION STATEMENT: Upon request the low bidders shall submit a Contractor's Qualification Statement, A.I.A. document A305. Failure to show a statement satisfactory to the Owner or Construction Manager will be reason to reject the bid as nonresponsive. Past performance on similar projects and your ability to perform the work on this project to the satisfaction of the Owner and Construction Manager and perform the work on schedule will be a priority in awarding a subcontract.

10. **Past Relative Experience**: List projects of similar size and scope of work. This information may also be attached to this proposal.

Project Name	Contract Amount	Completion Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

References:

Company	Contact	Phone/Email
_____	_____	_____
_____	_____	_____
_____	_____	_____

11. **COST FOR PAYMENT AND PERFORMANCE BOND:** **$**_____

Price NOT to be included in Base Bid

(If no amount is provided, it will be presumed that the subcontractor is unable to provide a bond for its work on this project).

Surety Company: _____ (Insurance Company)

Surety Agent: _____

Contact Information (Name & Phone Number): _____

THE BID DOCUMENTS ARE A COMPLETE PACKAGE. SUBCONTRACTORS BIDDING INDIVIDUAL SECTION(s) OR ANY PART THERE OF SHALL REVIEW ALL BID DOCUMENTS TO DETERMINE THEIR TOTAL SCOPE OF WORK AND INCLUDE ALL RELATED COSTS.

_____

Name of Bidder

_____Date_____

Authorized Signature

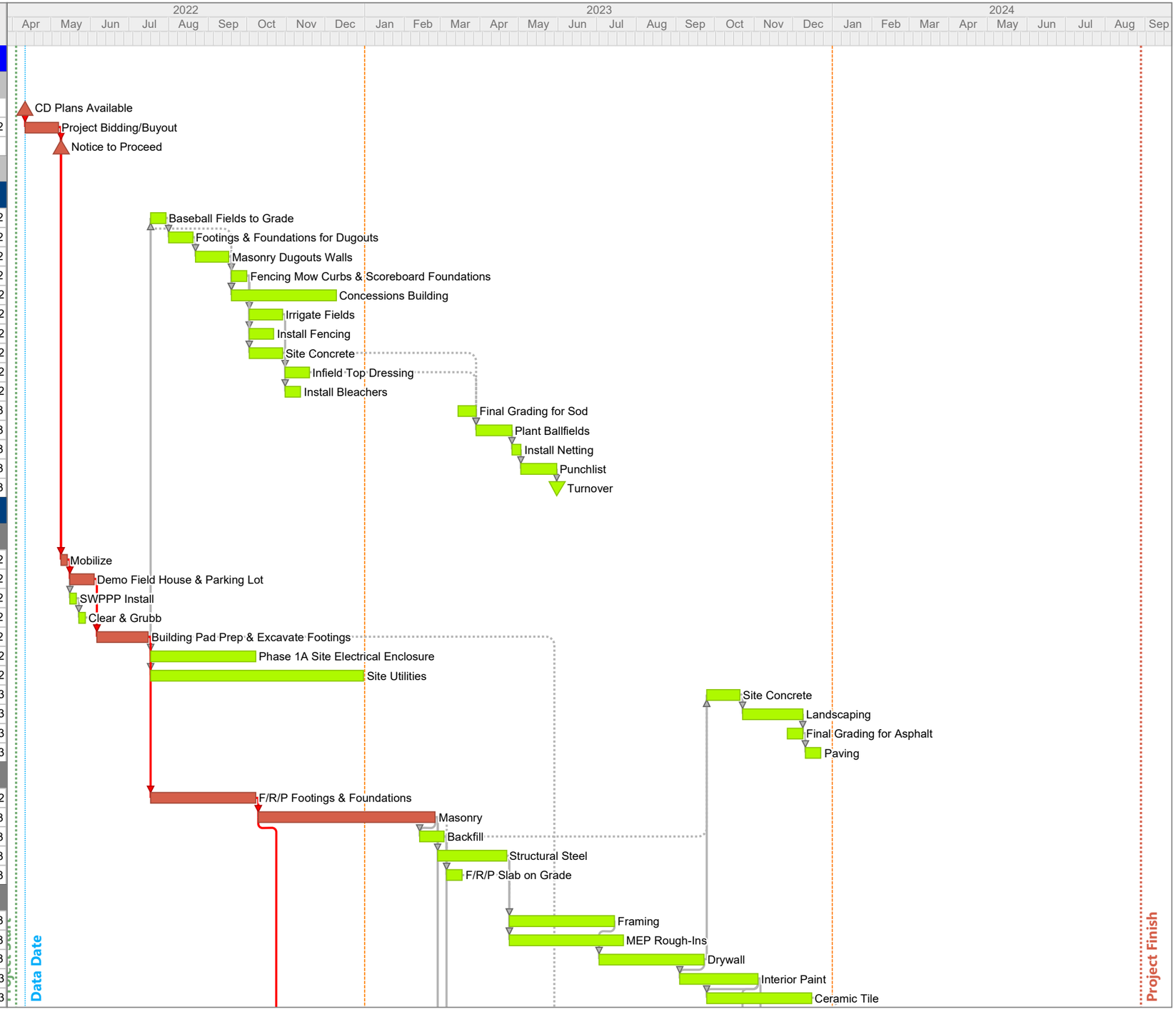
List all second-tier subcontractors, if any, you will contract with to complete the work if you are awarded the subcontract.

_____

_____

Value Engineering – (Optional) Include a description of each of your value engineering proposals and the cost impact that each would have on your bid listed above:

ID	Description	Original Duration	Start	Finish
Duchesne High Addition Bid Schedule				
Preconstruction				
20	CD Plans Available	0	04/11/22	
30	Project Bidding/Buyout	20	04/11/22	05/06/22
10	Notice to Proceed	0	05/09/22	
Construction				
City Playing Fields				
450	Baseball Fields to Grade	10	07/18/22	07/29/22
480	Footings & Foundations for Dugouts	15	08/01/22	08/19/22
490	Masonry Dugouts Walls	20	08/22/22	09/16/22
460	Fencing Mow Curbs & Scoreboard Foundations	10	09/19/22	09/30/22
495	Concessions Building	60	09/19/22	12/09/22
470	Irrigate Fields	20	10/03/22	10/28/22
500	Install Fencing	15	10/03/22	10/21/22
510	Site Concrete	20	10/03/22	10/28/22
520	Infield Top Dressing	15	10/31/22	11/18/22
530	Install Bleachers	10	10/31/22	11/11/22
535	Final Grading for Sod	10	03/15/23	03/28/23
540	Plant Ballfields	20	03/29/23	04/25/23
550	Install Netting	5	04/26/23	05/02/23
560	Punchlist	20	05/03/23	05/30/23
570	Turnover	0		05/30/23
Phase 1A				
Sitework				
55	Mobilize	5	05/09/22	05/13/22
60	Demo Field House & Parking Lot	15	05/16/22	06/03/22
65	SWPPP Install	5	05/16/22	05/20/22
75	Clear & Grubb	5	05/23/22	05/27/22
85	Building Pad Prep & Excavate Footings	30	06/06/22	07/15/22
86	Phase 1A Site Electrical Enclosure	60	07/18/22	10/07/22
90	Site Utilities	120	07/18/22	12/30/22
117	Site Concrete	20	09/25/23	10/20/23
119	Landscaping	35	10/23/23	12/08/23
127	Final Grading for Asphalt	10	11/27/23	12/08/23
128	Paving	10	12/11/23	12/22/23
Building Structure				
115	F/R/P Footings & Foundations	60	07/18/22	10/07/22
111	Masonry	100	10/10/22	02/24/23
113	Backfill	15	02/13/23	03/03/23
114	Structural Steel	40	02/27/23	04/21/23
105	F/R/P Slab on Grade	10	03/06/23	03/17/23
Interior Finishes				
122	Framing	60	04/24/23	07/14/23
135	MEP Rough-Ins	65	04/24/23	07/21/23
124	Drywall	60	07/03/23	09/22/23
130	Interior Paint	45	09/04/23	11/03/23
149	Ceramic Tile	60	09/25/23	12/15/23

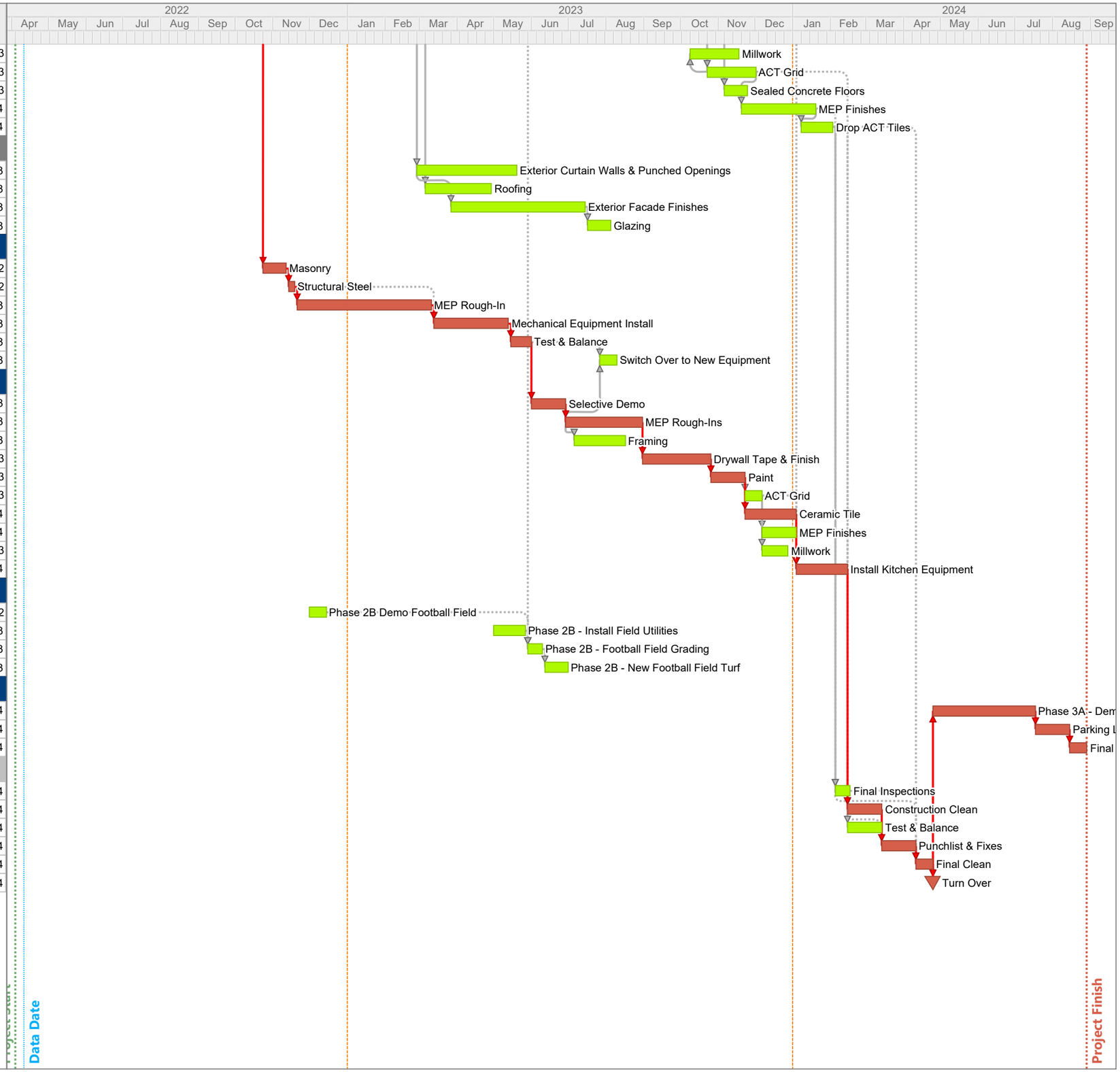


Start Date: 04/04/22
Finish Date: 08/29/24
Data Date: 04/11/22
Run Date: 04/01/22

Duchesne High School
Addition Bid Schedule

WESTLAND CONSTRUCTION

ID	Description	Original Duration	Start	Finish
133	Millwork	30	10/09/23	11/17/23
139	ACT Grid	30	10/23/23	12/01/23
132	Sealed Concrete Floors	15	11/06/23	11/24/23
144	MEP Finishes	45	11/20/23	01/19/24
146	Drop ACT Tiles	20	01/08/24	02/02/24
Exterior Finishes				
123	Exterior Curtain Walls & Punched Openings	60	02/27/23	05/19/23
125	Roofing	40	03/06/23	04/28/23
116	Exterior Facade Finishes	80	03/27/23	07/14/23
121	Glazing	15	07/17/23	08/04/23
Phase 1B				
118	Masonry	15	10/24/22	11/11/22
120	Structural Steel	5	11/14/22	11/18/22
126	MEP Rough-In	80	11/21/22	03/10/23
112	Mechanical Equipment Install	45	03/13/23	05/12/23
129	Test & Balance	13	05/15/23	05/31/23
136	Switch Over to New Equipment	10	07/27/23	08/09/23
Phase 2A				
131	Selective Demo	20	06/01/23	06/28/23
137	MEP Rough-Ins	45	06/29/23	08/30/23
138	Framing	30	07/06/23	08/16/23
141	Drywall Tape & Finish	40	08/31/23	10/25/23
142	Paint	20	10/26/23	11/22/23
143	ACT Grid	10	11/23/23	12/06/23
147	Ceramic Tile	30	11/23/23	01/03/24
145	MEP Finishes	20	12/07/23	01/03/24
148	Millwork	15	12/07/23	12/27/23
152	Install Kitchen Equipment	30	01/04/24	02/14/24
Phase 2B				
89	Phase 2B Demo Football Field	10	12/01/22	12/14/22
100	Phase 2B - Install Field Utilities	20	05/01/23	05/26/23
87	Phase 2B - Football Field Grading	10	05/29/23	06/09/23
88	Phase 2B - New Football Field Turf	15	06/12/23	06/30/23
Phase 3A				
180	Phase 3A - Demo Existing Auditorium	60	04/25/24	07/17/24
190	Parking Lot Utilities	20	07/18/24	08/14/24
200	Final Grading & Asphalt	10	08/15/24	08/28/24
Closeout				
158	Final Inspections	10	02/05/24	02/16/24
134	Construction Clean	20	02/15/24	03/13/24
159	Test & Balance	20	02/15/24	03/13/24
156	Punchlist & Fixes	20	03/14/24	04/10/24
163	Final Clean	10	04/11/24	04/24/24
174	Turn Over	0		04/24/24



GENERAL SITE NOTES:

1. Stalls designated as accessible will require a painted accessible symbol and sign. (See Details)
2. Fire lane markings and signs to be installed as directed by the Fire Marshall.
3. Aisle markings, directional arrows and stop bars will be painted at each driveway as shown on the plans.
4. Building sidewalks, ramps, and bollards are building contractor responsible items. See architectural plans.
5. All dimensions are to back of curb unless otherwise noted.

PRIVATE ENGINEER'S NOTICE TO CONTRACTORS

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the contractor shall defend, indemnify, and hold the owner and the engineer harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting for liability arising from the sole negligence of the owner or the engineer.

ALL CONSTRUCTION TO CONFORM TO CITY STANDARDS AND SPECIFICATIONS IN RIGHT OF WAY

	Note	Detail Reference
1	Construct Standard Asphalt Paving	
2	Construct Heavy Duty Asphalt Paving	
3	Construct Concrete Sidewalk, T=4"	
4	Construct Thickened Edge Walk	
5	Construct Concrete Paving	
	a) Thickness = 4"	
	b) Thickness = 6"	
6	Construct 24" Standard Curb & Gutter	
7	Construct 24" Spill Curb & Gutter	
8	Construct ADA Ramp	
9	Construct Curb Wall	
10	Construct Service Road, Match Existing	
11	Construct Ditch, Match Existing	
12	Construct Striping	
13	Construct ADA Striping	
14	Construct NO PARKING Striping	
15	Construct Crosswalk Striping	
16	Install "Stop" Sign	
17	Construct Chainlink Fence	
18	Construct Chainlink Fence	

Note	Detail Reference

Scale: 1" = 30'

30 0 15 30 40 50 60

Graphic Scale

Legend

(Note: All Items may not appear on drawing)

- San. Sewer Manhole (S)
- Water Manhole (W)
- Storm Drain Manhole (SD)
- Cleanout (C)
- Electrical Manhole (E)
- Catch Basins
- Exist. Fire Hydrant
- Fire Hydrant
- Fire Department Connection
- Post Indicator Valve
- Exist. Water Valve — WV —
- Water Valve — W —
- Sanitary Sewer — S —
- Culinary Water — W —
- Gas Line — G —
- Irrigation Line — IW —
- Storm Drain — SD —
- Telephone Line — T —
- Secondary Waterline — SW —
- Power Line — P —
- Fire Line — F —
- Land Drain — LD —
- Power pole
- Power pole w/guy
- Light Pole
- Fence
- Flowline of ditch
- Overhead Power line — OHP —
- Corrugated Metal Pipe CMP
- Concrete Pipe CP
- Reinforced Concrete Pipe RCP
- Ductile Iron DI
- Polyvinyl Chloride PVC
- Top of Asphalt TA
- Edge of Asphalt EA
- Centerline CL
- Flowline FL
- Finish Floor FF
- Top of Curb TC
- Top of Wall TWL
- Top of Walk TW
- Top of Concrete TCN
- Natural Ground NG
- Finish Grade FG
- Match Existing ME
- Fire Department Connection FDC
- Finish Contour — 90 —
- Exist. Contour — 90 —
- Finish Grade 95.33TA
- Exist. Grade 95.72TA
- Ridge Line — R —
- Direction of Flow
- Existing Asphalt
- New Asphalt
- Heavy Duty Asphalt
- Existing Concrete
- New Concrete
- Demo'd Road Base
- Spill Curb & Gutter
- Demo Tree
- Tree To Remain in Place

DHS PHASING PLAN

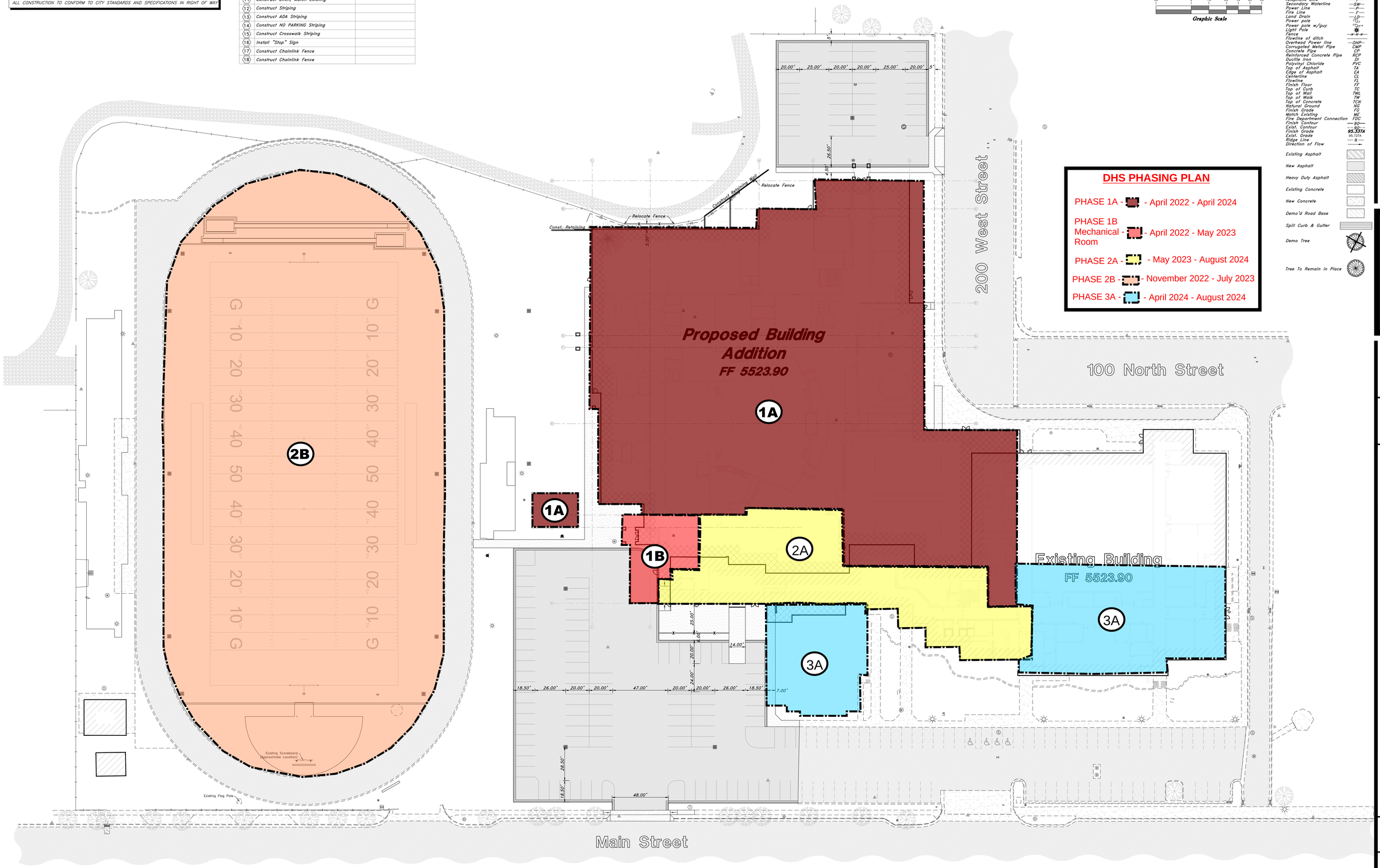
PHASE 1A - - April 2022 - April 2024

PHASE 1B
Mechanical - - April 2022 - May 2023
Room

PHASE 2A - - May 2023 - August 2024

PHASE 2B - - November 2022 - July 2023

PHASE 3A - - April 2024 - August 2024



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WWW.GREATBASINENGINEERING.COM

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REVISIONS:

DUCHESNE COUNTY SCHOOL DISTRICT
DUCHESNE HIGH SCHOOL PHASE III
175 WEST MAIN STREET
DUCHESNE, UTAH

DRAWN BY: BN
CHECKED BY: MEB
DATE: FEB. 2022
PROJECT #: 166019

Site Plan

CS100

WESTLAND CONSTRUCTION, INC.
1411 West 1250 South, Suite 200
Orem, UT 84058
Phone: (801) 374-6085 Fax: (801) 374-6060

SUBCONTRACT AGREEMENT

This Subcontract is entered into, effective as of **DATE**, by and between **WESTLAND CONSTRUCTION, INC.**, 1411 West 1250 South, Suite 200, Orem, Utah 84058 (hereinafter "Contractor") and the Subcontractor more particularly identified as:

SUBCONTRACTOR: **SUBCONTRACTOR LEGAL NAME**
ADDRESS
CITY, STATE, ZIP
Contact: CONTACT
Phone: ###-###-####
Cell: ###-###-####
Fax: ###-###-####
Email:

LICENSE #: _____.
STATE:

PROJECT: **Duchesne High School & Sports Complex**

OWNER: **Duchesne School District**

ARCHITECT: **KMA Architects**

Contractor and Subcontractor, for good and valuable consideration, agree as set forth below:

A. **SUBCONTRACT DOCUMENTS**: The Subcontract includes and incorporates by reference the Terms and Conditions attached hereto which include and incorporate by reference many other documents.

B. **SCOPE OF WORK**: Subcontractor shall supply and pay for all labor, material and services necessary to perform all of the work outlined below. The following is a general description of the work to be performed and completed by the Subcontractor, including all work and material as specified in noted section(s) and/or division(s): In Construction of the **PROJECT NAME**, per the drawings, contract documents and specifications prepared by XXXX ***Architects. dated #/#/2022*** including addendum No. 1 dated ##/##/#### for the following scope of work:

SUPPLY AND INSTALL COMPLETE, AS PER DRAWINGS AND SPECIFICATIONS

<INSERT SCOPE OF WORK & SUMMARY DESCRIPTION HERE>
All sections, as they pertain to the performance of this subcontract.

This project is tax exempt. Contract excludes sales tax on permanent materials in place.

Subcontractor will comply with all requirements as set forth in the project specifications including all plans and requirements as set forth in this Subcontractor Agreement. In addition, Subcontractor will require all lower tier subcontractors and suppliers to be bound by these same contract terms and conditions.

C. **CONTRACT AMOUNT**: WRITTEN AMOUNT Dollars and no/100 **($/total)**

D. **PAYMENTS**: Applications for monthly progress payments shall be in writing, on approved forms of Contractor, with cost breakdown. In addition, an unconditional lien waiver for subcontractor's suppliers and/or sub-subcontractors for the previous month payment must be submitted with pay request to the Contractor on or before the 25th day of each month. Subcontractor's payment application submitted on or before the 25th of the month will be for work completed and work estimated to be completed through the end

of the month. Contractor will issue payment to Subcontractor, by U.S. Mail only, within ten days of receiving payment from Owner.

E. **RETAINAGE: 5%** of Subcontractor's approved monthly billing will be held as retention until the work is accepted by Contractor and the Owner and until Contractor has received the retainage payment from the Owner. Subcontractor must submit a separate retainage invoice to receive payment of retention.

F. **SUBMITTALS**: **1 electronic copy (preferred) emailed to (Projectengineer)@westlandconstruction.com** as soon as possible, no later than DATE. Contractor and Architect's review of the Submittals will be for the limited purpose of checking for general conformance with the Contract Documents and will not be conducted for the purpose of determining the accuracy and completeness of details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Subcontractor. Contractor and Architect's review of Submittals will not relieve Subcontractor of its obligations under the Contract Documents. Contractor and Architect's review of Submittals will not constitute acceptance of safety precautions or construction means, methods, techniques, sequences or procedures. Contractor and Architect's acceptance of a specific item will not indicate acceptance of an assembly of which the item is a component.

G. **ATTACHMENTS**: The attachments A, B, C, D, E, F and G referenced hereto are incorporated herein.
Attachment A: (attached to back of Subcontract Agreement)
Attachment B: Subcontractor Disclosure Statement
Attachment C: Subcontractor's Certificate and Request for Payment and Conditional Waiver and Release
Attachment D: Conditional Waiver and Release Upon Progress Payment
Attachment E: Unconditional Waiver and Release Upon Progress Payment
Attachment F: Certification of Legal Work Status
Attachment G: Drawing Schedule

TERMS AND CONDITIONS OF SUBCONTRACT AGREEMENT

1. GENERAL PROVISIONS:

1.1 **Subcontract Documents**. The Subcontract Documents include: (1) this agreement, (2) any attached exhibits, (3) the prime contract between the Owner and Contractor including the General, Supplementary and other conditions of the prime contract, (4) the drawings and specifications, including all addenda issued prior to and all modifications issued after execution of the prime contract between the Owner and Contractor, (5) the project schedule, (6) all change authorizations or modifications to this agreement issued by the Contractor, (7) other documents listed herein or in the prime contract. These form the Subcontract Documents and are as fully a part of this Subcontract as if attached or repeated herein. Contractor and Subcontractor are hereby strictly bound to each other by the terms and requirements of the Subcontract. This Subcontract shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Contractor and Subcontractor.

1.2 **Scope of Work**. The work to be performed by the Subcontractor includes that work specifically set forth in this Subcontract, as well as any and all other work incident or related thereto, including, but not limited to, that work reasonably necessary for a complete and proper Project, or which is necessary to have a properly working and totally acceptable system and Project. All work covered by this Subcontract shall be performed in a skillful and workmanlike manner with material, equipment, etc. being both new and of the best kind and grade for the purpose intended. It being the express intent of the parties hereto that all work usually performed by the trades covered by this Subcontract and required by the Prime Contract shall be performed by the Subcontractor, in addition to that work specifically set forth herein.

The Subcontractor shall provide, at its own expense, all temporary and permanent tools, scaffolding, hoisting facilities, elevator service, implements, storage space, shop and working drawings, test, samples, models, guarantees, permits (excluding building permits), licenses, unloading facilities and services, and all other items necessary for the proper performance of this Subcontract and acceptance of the Project. The Subcontractor shall pay for all inspection fees that are related to re-inspection of defective work, royalties,

and license fees. The Subcontractor agrees to assume full responsibility for the accuracy of all lines, levels and measurements and their relation to bench marks, property lines, reference lines and the work of Contractor or other Subcontractors. Subcontractor is responsible for all lay-out, chalk-lines, survey, and work related to establishing necessary lines and grades. In all cases where dimensions are governed by conditions already established, the responsibility for correct knowledge of such conditions shall rest entirely on Subcontractor. No variation from specified lines or grades or dimensions shall be made except on the written authority of Contractor.

1.3 **Clean-up**. Subcontractor is responsible for clean-up of its work and/or payment of Subcontractor's prorate share of labor and facilities required for job clean-up, including regular and prompt removal and off-site disposal of all debris and rubbish occasioned by its work. To the extent any snow or ice needs to be removed for Subcontractor to perform its work, it shall be removed by Subcontractor at its sole expense. If Subcontractor elects to use dumpster provided by Contractor, Subcontractor agrees to pay its proportioned share of costs as determined by the Project Superintendent.

1.4 **Contractor Furnished Items**. Contractor shall furnish the following facilities at no cost to Subcontractor: (1) power – at least one location on site; (2) water – at least one location on site; (3) sanitary facilities.

2. PERFORMANCE OF WORK:

2.1 **Commencement of Work**. If Subcontractor has received its copy of this Subcontract for signature and commences work on site prior to signing this Subcontract, Subcontractor's commencement of work shall be deemed to be acceptance by Subcontractor of this Subcontract in its entirety. By signing this Subcontract or commencing work, **Subcontractor represents that it has visited and inspected the nature, locality and site of the work and the conditions and difficulties under which the work is to be performed, and that it enters into this Subcontract on the basis of its own examination, investigation and evaluation of all such matters and not in reliance upon any opinions or representations of Contractor, or Owner, or of any of their respective officers, agents, or employees. Subcontractor further represents that it has carefully reviewed and understands the Subcontract Documents** and is thus aware of any impact, relationship, or interference which the site, site conditions, climate, construction sequence, Subcontract Documents, and/or the work of other subcontractors or contractors will have upon Subcontractor's access, operations, efficiency, etc. Subcontractor further represents that it has reviewed and agrees to the schedule of Contractor.

2.2 **Timely Performance**. **Time is of the essence of this Subcontract**. Subcontractor therefore agrees: (1) to procure and prepare its materials so as to be ready to begin work when directed by Contractor, (2) to plan, prosecute, and complete its work in a prompt and diligent manner so as not to delay, disrupt, hinder or interfere with the work of Contractor or other subcontractors, (3) to commence the several parts thereof at such times and proceed therewith in such order as may be directed by Contractor (4) to provide, at its expense, additional workers and/or to work on an overtime or shift basis should Contractor reasonably so direct, (5) to do all layout, cutting, fitting and patching of its work as may be required to make its several parts come together properly and to fit it to receive or be received by the work of Contractor or other subcontractors, all as shown upon or reasonably implied by the Subcontract Documents, (6) to proceed in a skillful and expeditious manner, with sufficient labor, materials, tools, equipment, and supplies, (7) to complete the several parts and the whole of said work as provided herein so that, in conjunction with other subcontractors engaged thereon, Subcontractor will ensure the uninterrupted progress of the project and enable Contractor to complete the project as scheduled by Contractor.

2.3 **Schedules**. For purposes of scheduling the work, Contractor may periodically develop and modify project schedule(s). The Subcontractor agrees to furnish to Contractor any information necessary for Contractor to prepare its schedule(s). The float on the project schedules belongs to Contractor for us in scheduling the work. Contractor retains the right to modify, suspend, delay or accelerate, in whole or in part, said schedule(s), change work sequences and priorities, and to otherwise schedule the work so as to achieve timely project completion. So long as such modifications, changes in sequence, etc., are not arbitrary and capricious, Subcontractor agrees to adapt its efforts and to meet Contractor's schedule(s) as modified without additional cost to Contractor and/or Owner.

2.4 **No Damage For Delay**. Should Subcontractor's performance be delayed, hindered, interfered with, or otherwise disrupted by any act of Contractor, owner, other subcontractor or supplier, whether avoidable or unavoidable, reasonable or unreasonable, or foreseeable or unforeseeable Subcontractor's sole and exclusive remedy shall be an equitable time extension for the performance of the work, but only if Subcontractor shall have notified, in writing, Contractor of the cause of delay within seven (7) days of the occurrence of the event, and, provided a similar time extension of time is allotted to the Contractor by the owner. Subcontractor shall not be entitled to and hereby expressly waives any claim for any increase in the subcontract price or for additional damages or compensation as a consequence of such delays, unless the owner is liable and pays for such delays.

2.5 **Failure to Perform the Work**. If Subcontractor shall at any time: (1) refuse or neglect to supply a sufficient number of properly skilled workers or sufficient materials of the proper quality, or (2) fail in any respect to prosecute the work promptly, or (3) fail promptly to remove and replace work condemned by Owner, Architect or Contractor and make good work of others damaged by said replacement, or (4) cause by any action or omission the stoppage of, delay of or interference with the work of Contractor or of any other subcontractor, or (5) fail in the performance of any of the material covenants herein contained, or (6) be adjudged as bankrupt or make a general assignment for the benefit of creditors, or (7) become insolvent or a debtor in reorganization, receivership, composition or arrangement proceedings, then forty eight (48) hours after delivery of a written notice to Subcontractor indicating the existence of any of the foregoing causes, and unless the cause specified in such notice is eliminated within such forty eight (48) hours, Contractor at its option may provide, either by itself or through others, labor and materials to prosecute and complete the work and shall deduct the cost thereof from any amounts then due or thereafter to become due to Subcontractor. In any such event, after such notice and Subcontractor's failure to eliminate such cause within the forty eight (48) hours specified, Contractor may at its option (and without prejudice to any other remedy Contractor may have) terminate all or part of this Subcontract "for cause" and, for the purpose of completing the work, take possession of all or part of the materials and equipment of Subcontractor at the project site, all of which Subcontractor hereby assigns to Contractor. Contractor may then complete the work by whatever reasonable method Contractor deems expedient. In case of such partial or total termination the Subcontractor shall not be entitled to receive any further payment until the work required by this Subcontract is fully complete and accepted by Owner and Architect; and at such time, if the unpaid balance of the amount to be paid hereunder exceeds Contractor's costs, such excess shall be paid by Contractor to Subcontractor; but if Contractor's cost exceeds the unpaid balance, Subcontractor shall promptly pay the difference to Contractor. "Costs", as used in this Paragraph, shall include: (1) Contractor's expenses incurred in taking over and completing Subcontractor's work, (2) damages incurred by Contractor due to Subcontractor's non-performance, etc., and (3) 15% for Contractor's overhead and profit.

2.6 **Damages**. If Subcontractor fails to prosecute the work as required in this Subcontract, Subcontractor and its surety, when applicable, shall be liable for both: (1) liquidated damages, if any, assessed against Contractor by Owner related in whole or in part to Subcontractor's (or any other person or entity for whose acts Subcontractor may be liable) non-performance, and (2) actual damages incurred by Contractor and it subcontractors and suppliers caused or contributed to by delay caused by Subcontractor's responsibility for such damages shall exist regardless of whether Contractor elects to take over Subcontractor's work. In the event liquidated damages or actual damages, or both, are caused by Subcontractor and another entity, Contractor shall have the right to reasonably apportion said damages between the parties, and such apportionment shall be binding on Subcontractor. Contractor and Subcontractor shall not be liable to one another for any delays arising out of acts of God.

2.7 **Other Subcontractors**. Contractor shall not be liable to Subcontractor for any damages, loss or expense resulting from acts of omissions (whether or not negligent), failure to perform, delays in performance, or defaults of a supplier or another subcontractor in connection with the performance of any of the work covered by the Prime Contract and/or this Subcontract. Subcontractor agrees that any project supplier or other subcontractor shall have a direct right of action against Subcontractor for damages, loss or expense resulting from Subcontractor's acts or omissions (whether or not negligent), failure to perform, delays in performance, or default.

2.8 **Safety**. At all times while any of Subcontractor's employees, agents, or subcontractors are on the Owner's premises, Subcontractor shall be solely responsible for providing them with a safe work place of

employment, and Subcontractor shall inspect the places where its employees, agents or subcontractors are or may be present on Owner's premises and shall promptly take action to correct conditions which are or may become an unsafe place of employment for them. Subcontractor, its agents, employees, materialmen and subcontractors shall perform its work in a safe manner, including, but not limited to: (1) to comply with all safety regulations, including the applicable Occupational Safety & Health Act and all regulations adopted there under, (2) to provide safe tools and equipment, (3) to hold weekly safety meetings, (4) to install barricades, signs, flags, lights and other safe guards to prevent injury to workers and others on or about the construction site, (5) to provide superintendent with a copy of Material Safety Data Sheets (MSDS) for each chemical or hazardous material subcontractor has delivered to the project, (6) to make certain that hazardous material containers are properly labeled and that all of subcontractors employees have been properly trained on the care, handling, and use of the hazardous materials, (7) that the workers job attire, at a minimum, shall include long or short sleeve shirts, long pants, leather shoes or boots, safety glasses and hard hats and such other appropriate safety equipment, and (8) to have its employees and subcontractors conform to Contractor's drug free work place policy which shall be displayed on the job site, (9) provide contractor a copy of subcontractor's written safety program. Subcontractor shall indemnify and save harmless Contractor and Owner, and their officers, employees and agents, from any and all claim, loss or liability, including attorney's fees, arising out of Subcontractor's failure to comply with this provision.

The person in subcontractor's organization responsible for safety:

Name: _____

Cell # _____

2.9 **E.E.O./Affirmative Action**. Subcontractor shall fully comply with wage-hour regulations and shall take vigorous affirmative action to comply with E.E.O. and Affirmative Action Clauses as required by Executive Order 11246, 41 CFR 60-1.4, 41 CFR 60-1.7(b), 41 CFR 60-250.4, 4.1 CFR 60-741.1, 41 CFR 300.44(f)(1)(ii), CFR 60-741.44(f)(1)(ii) and the related regulation of Secretary of Labor, 41 CFR, Chapter 60 as revised, amended or suspended whenever lawfully required and is encouraged to do so in the absence of such requirement.

2.10 **Fines**. Subcontractor to indemnify Contractor against any and all fines, costs, and expense incurred by Contractor as a result of Subcontractor's failure to comply with any law, regulation or directive by any and all government entities. If Subcontractor's alleged acts or omissions result in a fine or penalty being levied against Contractor by OSHA or any other lawful regulatory agency or court, then the amount so levied shall be for Subcontractor's account and shall be deducted from amounts otherwise due Subcontractor. If the amount of fines exceeds the amount of Subcontractor funds that are available for offset, then Subcontractor will within 10 days reimburse to the Contractor the amount of deficiency.

2.11 **Supervision**. Subcontractor shall provide competent and continuous supervision of its work. Instructions given by Contractor to Subcontractor's superintendent or foreman and documents executed by said superintendent or foreman shall be binding upon Subcontractor.

2.12 **Acceptance of work**. All work shall be done, in strict accord with the prime contract, subject to the final approval of the Contractor, Owner, and Architect. The Architect's decision in matters relating to artistic effect shall be final.

2.13 **Acceptance of the Work of Others**. Should the proper performance of any work under this Subcontract depend upon the proper performance of any work or material furnished by contractor or others, Subcontractor agrees to use all reasonable means necessary to discover any defects and report them in writing to Contractor before proceeding with its work. Subcontractor shall allow Contractor a reasonable time in which to remedy such defects. In the event Subcontractor does not so report any defects to Contractor in writing, then it shall be presumed that Subcontractor has fully accepted the work of others as being satisfactory. Subcontractor shall be fully responsible thereafter for satisfactory performance of the work covered by this Subcontract, regardless of the defective work of others. Contractor disclaims responsibility for data, documents, drawings or information of any nature whatsoever provided by Owner or

Architect. The accuracy of such information is not warranted, and it is the Subcontractors responsibility to verify its accuracy.

2.14 **Incidental Charges**. Unless otherwise noted in this Subcontract, reasonable amounts for unloading, hoisting, clean-up, templates, layout or other services provided by Contractor for Subcontractor, and reasonable amounts for Contractor's equipment, tools, etc.., used by Subcontract shall be deducted from amounts otherwise due Subcontractor. Charges for incidental extra work performed by one party at the request of the other party, or for the benefit of the other party, or in the event of default by the other party shall be charged at direct field cost plus a 15% charge for home office overhead and profit and shall be executed as a change order.

2.15 **Permits, Fees and Codes**. Subcontractor shall, at its own cost and expense pay all fees related to the execution of its work; apply for and obtain all necessary permits (Excluding building permits), licenses, etc.; and conform strictly to the laws, building codes and ordinances in force insofar as applicable to the work covered by this Subcontract.

2.16 **Independent Contractor**. Subcontractor represents and agrees that it is an independent contractor in fact and also within the scope of the United States Internal Revenue Code; Social Security, and unemployment insurance laws and regulations; applicable safety, health and environmental laws and regulation (e.g. OSHA, MSHA); and applicable collective bargaining agreements and is therefore solely responsible for: (1) its compliance with such laws, regulations and agreements, (2) all payroll taxes, and (3) all trust fund and other deductions, withholdings and contributions payable under such laws, regulations and agreements. The contract amount includes all applicable sales and use taxes; franchise, excise and other taxes; and governmental impositions of all kinds and is not subject to any addition for any such taxes or impositions now or hereafter levied.

2.17 **Guarantee/Warranty**. During the guarantee (or warranty) period(s) established in the Subcontract, and if no such period(s) be therein stipulated, then for a period of one (1) year from date of final completion of the total project, Subcontractor agrees to promptly make good, solely at its expense, any work performed by Subcontract contrary to the Subcontract (including all defects due to defective workmanship and/or materials) and all damage and other losses resulting therefrom. Subcontractor further agrees to provide, in writing, any guarantees, maintenance agreements or other documents related to the work above described required by the Subcontract. Subcontractor's responsibility for latent defects shall extend beyond the guarantee period to the maximum extent as applicable statutes permit.

3. **CHANGE ORDERS/FIELD ORDERS:**

Contractor may add to or deduct from the work required by this Subcontract and any changes so made shall be defined only by Contractor's written Change Order or by Contractor's written Field Order. Contractor's Project Manager is the only person authorized to sign for a Change Order or Field Order. Contractor's Superintendent is only authorized to sign off in verifying Subcontractor's resources, employees and hours worked, materials, and equipment when required. In no instance is Contractor's Superintendent authorized to approve the cost or change in the work of a Change Order or Field Order. A Change Order is executed before the performance of the work and sets forth the changes involved and the value and time impact thereof, which value and time impact shall be mutually agreed upon between Contractor and Subcontractor and Owner (if possible). A Field Order is a written order from Contractor to Subcontractor directing a change to the work and setting forth a proposed basis for adjusting the Subcontract price and time (if any). A Field Order is used in the absence of total agreement on the terms of a Change Order. A Field Order will be replaced by a Change Order after the price and time impacts have been agreed to. If mutual agreement is not possible, then the price and time impact shall be determined as provided in Article 7 of this Subcontract. In either event, Subcontractor agrees to proceed with the work as changed when so ordered in writing by Contractor so as not to delay the progress of the work and pending determination of the value thereof. No claim for additional compensation, whether on account of extra labor and/or materials furnished, changed conditions, or otherwise, shall be paid unless the same is furnished pursuant to a written Change Order or Field Order signed by Contractor. Subcontractor shall provide Contractor with detailed pricing and time extension information for a proposed change in the work within seven (7) days of receipt of information regarding said proposed change. Subcontractor shall provide Contractor with detailed pricing and time

extension information for alleged changed conditions within seven (7) days of encountering alleged changed conditions. **Subcontractor shall not be entitled to compensation or time extension for claimed changed conditions unless written claim for same is received by Contractor within seven (7) days.**

Subcontractor shall review each change order or request for change order or directive issued by the Owner, and advise Contractor, in writing, within 7 days of receipt, as to the impact, if any, on Subcontractor's work, including any adjustment in Subcontract time or price. Subcontractor shall proceed with the changed work as directed by Contractor while such claim for adjustment is being determined by this Subcontract.

4. **PAYMENTS:**

4.1 **Cost Breakdown**. Within twenty (20) days of the date of this Subcontract, Subcontractor shall submit for Contractor's review and approval a detailed true cost breakdown of the contract amount sufficiently itemized as to work elements, labor, equipment, materials, etc., to allow Contractor to monitor Subcontractor's progress and to evaluate Subcontractor's periodic billings. Subcontractor's overhead and profit shall be distributed on a prorated basis to each line item. An intentionally unbalanced distorted or misrepresented cost breakdown shall be deemed to be fraudulent.

4.2 **Billings/Payments**. Contractor shall make, on account of the Subcontract price (adjusted by approved Change Orders, if any), monthly payments to Subcontractor for that portion of the work satisfactory performed in the preceding month in accordance with monthly billings prepared by Subcontractor and as approved by Contractor, Architect/Engineer and Owner. Applications for monthly progress payments shall be in writing, on approved forms of Contractor, with cost breakdown. In addition, an unconditional lien waiver for subcontractor's suppliers and/or sub-subcontractors for the previous month payment must be submitted with pay request to the Contractor on or before the 25th day of each month. Contractor will release payment to Subcontractor within ten (10) days of receiving payment from Owner. In the event Contractor does not receive from Subcontractor a proper and reasonable monthly billing prior to the date set forth above, Contractor may include in its monthly billing to Owner such amount, if any, as Contractor shall deem proper for the work of Subcontractor, and Subcontractor agrees to accept the approved portion, if any, as its monthly payment. Subcontractor shall also submit Supplier Affidavits, on Contractor's forms, as a condition precedent to receiving payment from Contractor. Subcontractor agrees that Contractor has the right to communicate with any subcontractor or supplier of Subcontractor regarding the status of payment by Subcontractor.

As an absolute condition precedent to Subcontractor's entitlement to any payment under this Subcontract, Contractor shall have first received from the Owner (unless the Owner's failure to make payment shall have been caused exclusively by Contractor) the corresponding periodic payment including the approved portion of Subcontractor's monthly billing. The Subcontractor acknowledges that it relies on the financial ability of the Owner and not the Contractor for payment of the work.

4.3 **Payments by Subcontractor**. Subcontractor shall pay for materials, equipment, and labor used in connection with performance of this Subcontract through the period covered by previous payments received from Contractor, and shall furnish releases, and satisfactory evidence, when requested by Contractor, to verify compliance with these requirements. If payment for material stored off-site and not delivered to the site is requested and made, title to such material shall pass to Contractor but Subcontractor shall remain fully liable for all such material not delivered to the job site and shall be responsible for providing insurance for such stored material.

4.4 **Payments Withheld**. Payments otherwise due Subcontractor, including payment of retainage and final payment, may be withheld by Contract on account of: (1) failure of Guarantor(s) to sign the Guarantee Agreement, if required, (2) failure of Subcontractor to provide surety bonds, if required, (3) failure of Subcontractor to provide acceptable and current certificates of insurance, (4) failure of Subcontractor to provide an acceptable cost breakdown, (5) failure of Subcontractor to complete Contractor's Supplier Affidavit and monthly lien release forms, (6) failure to sign or resolve change order for current billing period, (7) defective work of Subcontractor not remedied, (8) failure of Subcontractor to make payments owing to its employees, suppliers, or subcontractors for material, services or labor, (9) claim(s) filed by or involving Subcontractor or reasonable evidence indicating the probability of such a claim being filed, (10) failure of

Subcontractor to perform per schedule or commitment made by Subcontractor according to this agreement, (11) failure of Subcontractor to perform per Contractor's schedule, or (12) a reasonable doubt that Subcontractor can complete the work of this Subcontract for the balance then unpaid.

4.5 **Right to Offset/Joint Checks**. Contractor may offset against any sums due Subcontractor hereunder the amount of any obligations of Subcontractor to Contractor whether or not arising out of this Subcontract. Whenever Contractor reasonably so elects, Contractor may issue joint checks to Subcontractor and its suppliers and subcontractors. Contractor's options, set out in this Paragraph, confer absolutely no enforceable rights upon any third party.

4.6 **No Implied Acceptance**. Payment to Subcontractor pursuant to monthly or final billings shall not constitute nor imply acceptance by Contractor, Architect or Owner any portion of Subcontractor's work.

4.7 **Liens**. Subcontractor shall complete Contractor's monthly lien release and supplier affidavit forms, and save and keep the project and improvements referred to in this Subcontract and the lands upon which they are situated free from all liens and encumbrances, including, but not limited to, mechanic's and materialmen's liens arising out of its work. If Subcontractor fails to remove any lien, by bonding or otherwise, Contractor may retain sufficient funds out of any amounts due or thereafter to become due by Contractor to Subcontractor to pay the same and all costs incurred by reason thereof, and may pay said lien or liens and costs out of any funds at any time in the hands of Contractor owing to Subcontractor.

4.8 **Final Payment and Retainage**. The retainage portion of Subcontractors' approved monthly billings, and any other portion of the contract amount which is unpaid at the time of project completion shall be retained by Contractor, and shall not be paid to Subcontractor until: (1) Contractor receives final project retainage payment from Owner, (2) Architect and Owner accepts Subcontractor's work, guarantees, etc., and (3) Subcontractor furnishes Contractor with satisfactory evidence that all obligations incurred by Subcontractor pursuant to this Subcontract have been paid in full. Subcontractor must submit an invoice for retainage to receive payment for retainage. Acceptance of final payment by Subcontractor shall constitute a waiver of any and all claims by Subcontractor against Contractor, Owner and Architect and Subcontractor agrees to hold the Contractor harmless from any and all claims the Subcontractor may have against the Contractor. Any payment, however, final or otherwise, shall not release the Subcontractor or its sureties from any obligations under this agreement.

5. **INSURANCE AND DUTY TO DEFEND, INDEMNIFY & HOLD HARMLESS**:

5.1 **Certificates of Insurance**. Prior to commencing its work on site and prior to receiving a payment otherwise due per this Subcontract, Subcontractor shall furnish and thereafter maintain certificates of insurance and indemnification satisfactory to Contractor evidencing compliance with the terms of this Subcontract. Said certificates of insurance and the policies represented thereby shall not be canceled or modified until thirty (30) days after written notice has been given to Contractor. Subcontractor's Insurance shall provide an endorsement affording (30) days' notice of cancellation to Contractor. Required coverage shall be maintained without interruption from the date Subcontractor commences work under this Subcontract through the Statute of Repose. By accepting certificates of insurance from Subcontractor, Contractor does not waive any terms or conditions outlined in this Agreement and this Agreement shall supersede any and all other agreements (as stated in Section 8.3).

5.2 **Worker's Compensation Insurance**. Subcontractor agrees to provide and maintain Worker's Compensation Insurance as required by statute, and Employer's Liability insurance with the following limits:

(a)	Bodily Injury by Accident	$100,000 each accident
(b)	Bodily Injury by Disease	$100,000 each employee
(c)	Bodily Injury by Disease	$500,000 policy limit

and to comply in all respects with the terms for employment and payment of labor required by Owner or any constituted authority having legal jurisdiction over the work. If for whatever reason, Subcontractor waives coverage under any applicable worker's compensation policy for any of its owners, then to the extent permitted by law, Contractor shall not be liable for Subcontractor's claims, losses, damages, or expenses

which would otherwise be payable under an applicable worker's compensation policy. Subcontractor shall use insurance companies licensed to do business in the state in which the Work is performed, and with an A.M. Best rating of not less than A-, size VII or better. Said rating shall be as published by A.M. Best Company at the time the Contract is executed.

5.3 **Liability Insurance**. Subcontractor shall maintain such Commercial General Liability insurance, including Automobile and blanket contractual liability as will protect Subcontractor from claims for damage because of bodily injury, including death, or damage because of injury to or loss, destruction, or loss of use of property which may arise from its operations under this Subcontract, whether such operations be by Subcontractor or its subcontractors or anyone directly or indirectly employed by either of them.

Subcontractor's liability insurance shall provide the greater of the minimum limits set forth in the General Contract or the following minimum limits of coverage:

(1) Commercial General Liability

(a) General Aggregate $2,000,000

(b) Products – Completed Operations Aggregate $2,000,000

Subject to a per project general aggregate provision applicable to the project.

(c) Each Occurrence $1,000,000

(d) Personal & Advertising Injury $1,000,000

Subcontractor's general liability insurance shall include Contractor, Owner, and Architect as additional named insured for both ongoing operations and completed operations (ISO form CG2010 11/85 or its equivalent). Insurance shall be written on an occurrence basis equivalent to ISO Form CG 0001 10/01, rather than on a claims-made basis., and will be primary and non-contributory to any insurance of the additional insured.

(2) Comprehensive Automobile Liability (Combined Single Limit) $1,000,000
Covering owned, non-owned, and hired vehicles.

Subcontractor shall use insurance companies licensed to do business in the state in which the Work is performed, and with an A.M. Best rating of not less than A-, size VII or better. Said rating shall be as published by A.M. Best Company at the time the Contract is executed. All insurance policies shall include coverage for explosion, collapse, underground, property damage and work performed by Subcontractors. Equivalent insurance must be obtained from each sub-subcontractor and supplier. Otherwise their insurance must be included in Subcontractor's policy. The Subcontractor agrees to furnish evidence satisfactory to the Contractor of such insurance, including copies of the policies when requested to do so by the Contractor.

In the event of threatened cancellation for nonpayment of premium, Contractor may pay same for Subcontractor and deduct the said payment from the amount then or subsequently owing to Subcontractor hereunder.

Subcontractor and Contractor each waive any right or claim to be subrogated on payment of loss or otherwise to any claim against Owner or the other and further waive any right against Owner or the other for damages caused by fire or other perils to the extent covered by property insurance being maintained by Owner or Contractor pursuant to the Contract Documents.

5.4 **Builder's Risk Insurance**. Subcontractor shall satisfy itself as to the existence, coverage and deductibles of Builder's Risk, property and/or equipment insurance prior to commencement of its work on the project. Upon Subcontractor's written request, Contractor shall provide Subcontractor with a copy of the Certificate of Builder's Risk insurance policy and any other property or equipment insurance in force for the project if said insurance has been procured by Owner. Until final acceptance of the project by Owner, Subcontractor shall be responsible for (1) loss or damage to its stored and installed materials, and (2) its prorate share of any deductible amount associated with an otherwise insured loss. Subcontractor has the option to insure against the deductible.

5.5 **Professional Liability Insurance**. If Subcontractor or any of its Sub-subcontractors or agents will provide any design, engineering or other professional services under the Subcontract documents, Professional Liability insurance shall be provided covering Subcontractor and Sub-subcontractors, and their respective professionals, for liability for negligent acts, errors, or omissions, arising out of the performance of the Subcontractor Work. The policy shall contain a blanket endorsement for contractual liability and afford coverage on a claims made basis (specific to the Project only):

Minimum Limits: Deductible not to exceed $100,000 per claim

Combined Single Limit for Each Occurrence	$1,000,000
Annual Aggregate Limit	$2,000,000

All coverage shall be retroactive to the earlier of the date of the Subcontract or the commencement of any services furnished under the Subcontract and shall be maintained for a period of (3) three years after the date of final payment under the Subcontract. Retroactive date of such policy must be on or before the date Subcontractor or it's Sub-subcontractors began offering professional services.

5.6 **Aircraft Liability Insurance**. If Subcontractor or any of its Sub-subcontractors or agents will operate aircraft in their scope of Work, a policy of aircraft insurance shall be provided on a standard form providing coverage for bodily injury (including death) and property damage for aircraft applicable to all owned, non-owned, and hired aircraft.

Minimum Limits: Combined Single Limit Per Occurrence $5,000,000

5.7 **Duty to Indemnify, Defend and Hold Harmless**. To the fullest extent permitted by law, Subcontractor shall indemnify, defend, and hold harmless Contractor and Owner, and their agents and employees against all claims, demands, damages, liabilities expenses and reasonable attorney fees incurred by Contractor and/or Owner arising out of or in any way related to the performance (or failure to perform) Subcontractor's obligations under this agreement, or anyone directly or indirectly employed by Subcontractor or anyone for whose acts Subcontractor may be liable, but only to the extent caused in whole or in part by negligent acts or omissions of the Subcontractor, its employees or agents, regardless of whether or not such claim ,loss, damage or expense is caused in part by the acts of one of the parties indemnified hereunder. Subcontractor shall also require in its agreement with its second-tier subcontractors to indemnify Contractor as set forth in this clause.

The obligations for indemnification herein required are severable. The inapplicability of any portion of the obligations for indemnification hereunder due to statute, court decisions, or any other basis, shall not nullify, reduce, or limit other obligations set forth herein. The obligation for Subcontractor to indemnify and hold harmless Contractor against claims, damages, losses, and expenses, including, but not limited to, attorneys fees, arising out of or resulting from the performance of Subcontractor's work under this Subcontract, due solely to the negligent acts or omissions of Subcontractor, will be deemed a severable distinct obligation to the extent found liable.

If there are any claims to persons or property unsettled for when the work herein provided for is finished, final settlement between Contractor and Subcontractor shall be deferred until such claims are adjusted, or suitable special indemnity acceptable to the Contractor is provided by the Subcontractor.

5.8 **No Limitation on Liability**. In any claim against Contractor and/or Owner by an employee of Subcontractor, anyone directly or indirectly employed by Subcontractor, or anyone for whose acts Subcontractor may be liable, the indemnification, duty to defend and hold harmless obligations in this Subcontract shall not be limited: 1) by any limitation on the amount or type of damages, compensation or benefits payable by or for Subcontractor under worker's compensation, disability benefit or other employee benefit acts or regulations, or 2) to the policy limits of any insurance coverage which Subcontractor maintains or is required to maintain.

6. **SUSPENSION / TERMINATION**:

6.1 **Suspension**. Contractor may, for its convenience or by direction, suspend the work, either in whole or in part, at any time upon written notice to Subcontractor stating the nature, effective date and anticipated duration of such suspension, whereupon Subcontractor shall suspend its work to the extent specified and shall place no further orders or perform no other work except as permitted by Contractor's notice of

suspension. During the period of such suspension, Subcontractor shall protect and care for all work, materials and equipment at the project site or at storage areas under its responsibility. The Subcontract price shall be adjusted as provided in Article 3 if the cost of the work is increased or decreased by reason of such suspension. If additional time for completion of the work is required as a result of such suspension, Subcontractor shall submit a written request for additional time. **Failure to submit a timely written request for additional time due to such suspension shall result in no extension of time being granted.**

6.2 **Termination for Convenience**. Contractor reserves the right to suspend or terminate the contract at any time for its convenience. In the event the Contractor decides to terminate all or part of the Subcontractor's work prior to project completion, then an equitable settlement for work performed under this Subcontract will be negotiated. Subcontractor shall receive, as its entire compensation, its actual, necessary, and reasonable costs of performing the work to the date of termination, as determined by audit of Subcontractor's records, plus a reasonable markup for overhead and profit. Subcontractor shall make its records available at reasonable times and places for Contractor's audit. In the event no agreement can be reached the matter will be resolved according to Article 7 of the Subcontract. In no event shall Subcontractor be entitled to prospective profits on unperformed work.

6.3 **Termination for Cause**. See Paragraph 2.5. In the event any termination of Subcontractor for cause is later determined to have been improper, the termination shall be automatically converted to a termination for convenience and Subcontractor shall be limited in its recovery strictly to the compensation provided for in the Termination for Convenience clause.

7. **DISPUTES:**

7.1 **Scope of Prime Contract**. In the event of a dispute arising between Contractor and Subcontractor with respect to whether the Prime Contract, including drawings and specifications, requires Contractor (and thus, perhaps, Subcontractor) to furnish any material or perform any labor, the decision of Architect shall be conclusive and binding. Should there be no architect or engineer over the work, then the matter in question shall be determined as provided in Paragraph 7.2.

7.2 **Methods of Resolution**. It is the general intent of the parties that any unresolved dispute relating to this contract shall be settled first by negotiation. In the event the parties do not negotiate a settlement the parties agree to participate in a minimum of four (4) hours of mediation in accordance with the mediation procedures of the American Arbitration Association, the cost of which shall be shared equally between the parties. Such mediation shall be a condition precedent to initiating or continuing any arbitration or litigation.

In the event the dispute, claim or other matter in dispute arising out of or related to this Subcontract or the breach thereof, is not resolved by negotiation or mediation, it shall be decided in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association at the sole discretion of Contractor. If a demand for arbitration is filed by Subcontractor, Contractor will advise Subcontractor, in writing, within 30 days after receipt of the demand for arbitration if Contractor exercises the option to arbitrate or rejects arbitration; such election, once made, shall be binding. The filing of a demand for arbitration by Contractor shall be deemed an election to arbitrate and shall constitute the exercise of the option of Contractor to proceed with arbitration.

Contractor may join or consolidate arbitration with the Owner, Architect, any other subcontractor, or any other party having an interest in the proceeding whose presence is required if complete relief is to be accorded in the arbitration. The decision of the arbitrator(s) shall be final and binding and shall be rendered in writing and may be entered for enforcement in any court of competent jurisdiction. Subcontractor shall carry on the work and maintain its progress during any legal or arbitration proceedings. The article shall not be deemed a limitation of any rights or remedies, which the Subcontractor may have under any Federal or State Mechanics Lien Laws or under any applicable labor and material payment bonds.

7.3 **Recovery of Attorney Fees, Interest, Etc**. In the event it becomes necessary for either party to enforce the provision of this Subcontract or to obtain redress for the violation of any provision hereof, whether by arbitration, or otherwise, the prevailing party shall be entitled to recover from the other party all costs and expenses associated with such action, including statutory interest and reasonable attorney fees.

7.4 **Consequential Damages**. Under no circumstances shall the Contractor be liable to the Subcontractor for consequential damages including, but not limited to, loss of use or loss of profit irrespective of whether resulting from negligence.

8. **ADDITIONAL PROVISIONS:**

8.1 **Subletting, Assignment, Etc**. **Subcontractor agrees not to transfer or sublet this Subcontract or any part thereof without the prior written consent of Contractor**. Subcontractor's rights to monies due hereunder are non-assignable except with the written consent of Contractor. Any assignment of monies due hereunder made without such consent is void.

8.2 **Owner Approval, Contact, Etc**. This Subcontract is subject to approval of Subcontractor by Architect and/or Owner. This Subcontract shall not become binding upon the parties hereto until the Prime Contract is executed by the parties thereto and approval for Contractor to proceed under the Prime Contract has been given by Owner or its representative.

8.3 **Sole and Entire Subcontract**. **This Subcontract is the sole agreement between the parties**. All verbal or written terms, conditions, proposals, opinions, representations, negotiations, and agreements made prior to the date of this Subcontract has, where appropriate, been made part of this Subcontract. It shall be binding upon the heirs, administrators, executors, successors, and assignees of the parties hereto. Except as specifically prescribed herein, this Subcontract shall not create any rights of or confer benefits upon, third parties. **No modification or change of the terms of this Subcontract shall be binding on Contractor unless approved in writing by an authorized officer or the designated Project Manager of the Contractor**.

8.4 **Notice**. Any notice, required to be given, to a party hereto shall be directed to such party and mailed by certified mail, personally delivered to an agent of the Contractor/Subcontractor, sent via electronic facsimile machine (fax), or via e-mail. Unless otherwise noted in this agreement, such notice shall be effective at the time received at the address indicated herein of such party. If noticed by facsimile or e-mail the notice shall be effective on the date sent unless sent after 5:00 pm. If sent after 5:00 pm then the notice becomes effective on the next day.

8.5 **Days**. All references to day or days shall mean calendar days.

8.6 **Non Enforcement Not a Waiver**. Failure on the part of either party to exercise its rights under the provision of this Subcontract for any breach of the provisions hereof by the other shall not constitute a waiver of such rights for any subsequent breach of any provision hereof.

8.7 **Severability**. Any provision of this Subcontract determined to be in violation of any law applicable thereto shall be void but that shall not affect the validity and enforceability of all other provisions hereof.

8.8 **Governing Law/Jurisdiction**. This Subcontract shall be deemed to have been made in and shall be interpreted under the laws in the jurisdiction in which the project is located.

8.9 **E-Verify**. Subcontractor shall certify to the Contractor by affidavit that the Subcontractor has verified through the Status Verification System (E-verify) the employment status of each new employee of Subcontractor, all in accordance with Section Utah Code Ann. Section 63G-11-103 and shall comply with all applicable employee status verification laws. Such affidavit must be provided prior to the notice to proceed for the Subcontractor to perform any portion of the work.
Subcontractor will require that the above stated provisions be placed in each subcontract at every tier. Subcontractor is responsible for providing to Contractor Certification by Affidavit by its lower tiered contractors verifying the use of the Status Verification System (E-verify).
Subcontractor shall protect, indemnify and hold harmless the Contractor and its officers, employees, agents, representatives and anyone that Contractor may be liable for, against any claim, damages or liability arising out of or resulting from the violation of this Section 8.9 whether violated by employees, agents or contractors

of (a) the Subcontractor, (b) Subcontractor's Sub-Subcontractor at any tier; and/or (c) any entity or persons from whom the Subcontractor may be liable.

See Attachment "F" – Certification of Legal Work Status

Contractor and Subcontractor acknowledge receipt of pages 1 through 15 of this document.

SUBCONTRACTOR LEGAL NAME

By: _____
Signature Date

_____
Printed Name & Title

WESTLAND CONSTRUCTION, INC.

By: _____.
Signature Date

_____Project Manager.
Printed Name & Title

Attachment A

W1118B EMERY HIGH SCHOOL BP2

As a subcontractor on the above listed project, I agree to comply with the following items in order to help the project run in a more timely and efficient manner.

- I agree to meet or complete our work sooner than the scheduled time that has been presented by Westland Construction on their schedule.
- I agree to have all employees wear hard hats while working on the project site.
- I agree to attend all job site coordination and safety meetings that are requested by Westland Construction's superintendent.
- I agree to have all monthly pay requests in to Westland Construction's Orem office **no later than the 25th** of the month.
- I agree to have all closeout documents and warranties in to Westland Construction's Orem office 30 days prior to final closeout of the project.

WESTLAND

PURCHASE ORDER

JOB NAME: Duchesne High School & Sports Complex **WESTLAND JOB #** W###

DATE: 2022 **DELIVERY ADDRESS:** 155 West Main Street Duchesne, Utah 84021

DELIVERY DATE: _____ **F.O.B:**_____

SELLER: _____

A: In strict accordance with drawings and specifications, including all general and supplementary conditions and attachments, we authorize you to supply the items listed below in the Scope of work. You hereby agree to the terms and conditions herein, including the additional Terms & Conditions accompanying herewith.

B: Scope of work or items supplied, as per drawings, specifications and contract documents prepared by

Pricing includes the completion of work in a timely manner to meet or exceed time requirements for accelerated Westland schedule. Changes in the Purchase Order must be authorized in writing by Westland Construction's project director or project manager prior to work being performed. *See Terms & Conditions accompanying herewith.*

C: Unit prices not to exceed total Purchase Order amount of:

_____

Freight Included _____ Tax Included _____

Seller's Signature:

_____

Printed Name:
Title:
SUBCONTRACTOR

Buyer's Signature:

_____

Aaron Kirkham
Project Manager
WESTLAND CONSTRUCTION, INC.

TERMS & CONDITIONS

1. **Acceptance.** This Purchase Order constitutes Buyer's offer to Seller and becomes a binding contract on the terms set forth herein when it is accepted by Seller, either by signing this Purchase Order or by the commencement of performance hereof. No revisions to this Purchase Order shall be valid unless in writing and signed by an authorized representative of Buyer prior to any work being performed. No conditions stated by Seller in accepting or acknowledging this Purchase Order shall be binding upon Buyer if in conflict with, inconsistent with, or in addition to the terms and conditions contained herein, unless expressly accepted in writing by Buyer. In the event of conflict in terms of Seller's contract proposal and this Purchase Order, the terms of this Purchase Order shall govern.

2. **Price Changes.** Prices specified on any purchase order accepted by Seller shall not be subject to change without Buyer's consent.

3. **Design Changes.** Buyer may at any time make changes in the applicable drawings, designs or specifications, or schedule. Adjustment of price resulting from such changes shall be made in proportion to the increase or decrease of cost to the Seller and shall be agreed to in writing from the Buyer prior to any change being implemented by the Seller.

4. **Packing & Crating.** All items shall be packed by Seller in suitable containers for protection in shipment and storage. Prices set forth in this Purchase Order include all charges for Seller's packing, crating, storage, and for transportation to F.O.B. point.

5. **Inspection.** All materials or articles will be subject to final inspection and approval at the Delivery Address by Buyer. Buyer reserves the right either to reject and hold, at Seller's expense subject to Seller's disposal, all materials or articles not conforming to drawings, specifications and/or samples if required under the terms of this Purchase Order, or to return without an order. If any merchandise fabricated by Seller from material furnished by Buyer is rejected by Buyer due to Seller's fault or failure to meet the requirements of drawings, specifications, and/or samples required under the terms of this Purchase Order, Seller shall, at Buyer's option, either replace such merchandise at its own expense or pay Buyer the replacement cost of the material used therein. Seller will be charged replacement costs of Buyer's materials or tools while in Seller's possession.

6. **Delivery.** Seller shall assume and pay any and all loss or damage to the materials and articles from any cause whatsoever until delivered to Buyer at the Delivery Address specified on this Purchase Order.

7. **Advance Manufacture and Shipments.** Seller shall not deliver any material in advance of the schedule set forth in this Purchase Order without Buyer's written permission. Buyer reserves the right to return, shipping charges collect, all material received at Buyer's ship to point in advance of their schedule shown on this Purchase Order. Seller may request Buyer's written consent to advance manufacture and/or deliver at time of returning acknowledgement of this Purchase Order. Shipments will be made in accordance with the Buyer's shipping schedule which is subject to revision with respect to undelivered quantities.

8. **Tools and Materials.** Title to and the right of immediate possession of all tooling, designs, patterns, drawings and materials furnished by Buyer to Seller for use hereunder shall be and remain in Buyer, in all stages of construction.

9. **Delays.** The Seller shall notify the Buyer promptly of any delays affecting the performance of this Purchase Order. The Seller shall indemnify the Buyer against any loss incurred by the failure of the Seller to perform in accordance with the accepted Purchase Order.

10. **Invoices.** Invoices and required Attachments should be received in the Westland Construction Orem office no later than the 25th of each month. Invoices are for work completed from the 1st through the 30th of the month. ALL billings must be on the Contractor's application for payment form. All invoices shall be paid by the 25th of the month following the month of invoice, or within 30 days after payment by Owner.

11. **Payment.** Payment for material on this Purchase Order shall not constitute an acceptance thereof, but all material shall be received subject to Buyer's inspection and rejection. Payment shall be made as stated on this Purchase Order, unless otherwise specifically arranged for and stated in this Purchase Order. In the event that merchandise has not been received, Buyer reserves the right to withhold payment until merchandise has been received and checked. Buyer's count will be accepted as final on all shipments not accompanied by packing list.

12. **General Warranty.** Seller warrants that all of the articles and all of the materials furnished under this Purchase Order are free and clear of all liens and encumbrances whatsoever and that Seller has a good and marketable title to same and Seller agrees to hold Buyer free and harmless against any and all claimants to said merchandise. Seller further warrants that all of the articles and all of the materials furnished under this Purchase Order will be free from defects in materials and workmanship, will conform to applicable specifications, drawings, samples or other descriptions given, and shall be fit and sufficient for the purpose intended, merchandisable of good material and workmanship, and free from defects. Said express warranty shall remain in effect as to each material and each article for a period of twelve (12) months after it is applied to a use for which it was designed. The foregoing period and time may be extended by written agreement and shall be deemed to be extended for such greater period of time as may be specified in Seller's standard warranty or service guarantee. The aforesaid express warranty shall be in addition to any standard warranty or service guarantee given to Buyer by Seller. All warranties shall be construed as conditions as well as warranties and shall not be deemed to be exclusive. All warranties and service guarantees shall run both to Buyer and to its customers. Seller will defend, indemnify, and save harmless Buyer from and against all claims of patent, trademark or copyright infringement of all unfair competition arising out of the sale, cataloging, marketing, packing, or advertisement of merchandise furnished by Seller; and against all claims for damages to person or property resulting from defects in material or workmanship, and/or from failure of Seller to comply with safety, inspection and labeling requirements of governmental agencies in force as applicable when goods are resold by Buyer.

13. **General Indemnity.** Seller, at its expense, shall (a) defend Buyer against any claim or action brought against Purchaser arising out of any act or omission of Seller, its agents, servants, employees or subcontractors during or resulting from fault performance of the goods purchased hereunder or any work performed under this Purchase Order and (b) indemnify and hold Buyer (and Buyer's successors in interest to the goods purchased hereunder) harmless from all claims, liabilities, losses, damages, costs, expenses and liabilities relating hereto (including without limitation reasonable attorney's fees). Seller shall have the right to control the defense of any such action and all negotiations for settlement. Buyer shall have the right, at its expense, to participate in the defense and settlement of such action and to be represented therein by counsel of its choice.

14. **Termination.** If the merchandise covered by this Purchase Order is standard stock merchandise, Buyer at its option may cancel at any time any unshipped portion of this Purchase Order without further obligation hereunder except to make payment, subject to other applicable terms hereof. For merchandise manufactured or fabricated to the specifications of the Buyer, or special specifications prepared by Seller for Buyer, Buyer may terminate such work under this Purchase Order in whole, or in part, at any

time by written or telegraphic notice to Seller; and upon such termination in whole, or in part of such work under this Purchase Order, Seller will stop work immediately, notify subcontractors to stop work, and protect property in Seller's possession in which Buyer has or may acquire an interest. Except where such termination is occasioned by a default or delay of Seller, other than one due to causes beyond Seller's control and without Seller's fault or negligence, Seller may claim reimbursement for Seller's actual costs incurred up to and including the date of termination which are properly allocable to or apportionable under recognized accounting practices to the terminated portion of the Purchase Order, including liabilities to subcontractors which are so allocable and acceptable finished units at contract price not previously billed or paid for, but excluding any charge for interest or any materials which Seller may be able to divert to other orders. Seller may also claim a reasonable profit on the work actually done by Seller prior to such termination, the rate of which shall not exceed the rate used in establishing the original Purchase Order Price. The total of such claim shall not, however, exceed the canceled commitment value of this Purchase Order.

15. **Patent Protection.** To the extent that the articles or materials delivered hereunder are not manufactured pursuant to designs originated by Buyer, Seller guarantees that the sale and/or use of any or all articles or materials delivered hereunder will not infringe any United States or foreign patents and agrees that Seller will save Buyer and/or its customers harmless from any loss, damage or liability which may be incurred on account of infringement or alleged infringement of patent rights with respect to such articles or materials, and that it will at its own expense defend any action, suit or claim in which such infringement is alleged, provided Seller is duly notified as to suits or claims against Buyer and provided further that Seller's indemnity as to use shall not apply to infringement arising from use in combination with other items where infringement would not have occurred from the normal use for which the article was designed.

16. **Insurance.** In the event that Seller is required to enter premises owned, leased, occupied by or under the control of Buyer during the performance of services ordered hereunder or during delivery or installation of materials or articles herein contemplated or during the performance of services otherwise required to be furnished by Seller, Seller agrees that Seller will indemnify and hold harmless Buyer, its officers and employees, from any loss, cost, damage, expense or liability by reason of property damage or personal injury of whatsoever nature or kind arising out of or as a result of the performance of such services and/or delivery and or installation, whether arising out of the actions of Seller or of its employees, subcontractors, or sub-subcontractors. Seller agrees that it and its subcontractors or sub-subcontractors will maintain public liability and property damage insurance in reasonable limits covering the obligations set forth above and will maintain proper workmen's compensation insurance covering all employees engaged in the performance of such services and/or delivery and/or installation.

17. **Reproduction Rights.** Buyer does not grant or convey to Seller by virtue of this Purchase Order (a) any reproduction rights in or to the articles called for hereunder or (b) any right to use designs, drawings or other information belonging to Buyer or supplied by or on behalf of Buyer for use in the performance of this Purchase Order for the production, manufacture or design of any articles or materials for anyone other than Buyer.

18. **Assignment.** Seller may not assign this Purchase Order, or sublet any part of this Purchase Order, without the prior written consent of Buyer. Claims for monies due or to become due under this Purchase Order may be assigned by Seller, provided that Seller shall supply Buyer promptly with two copies of any such assignment, and provided further that payment to an assignee of any claims under this Purchase Order shall be subject to set-off or recoupment for any present or future claim or claims which Buyer may have against Seller.

19. **Cancellation for Insolvency.** In the event of any suspension of payment or the institution of any proceedings by or against either party, voluntary or involuntary, in bankruptcy or insolvency, or for the appointment of a receiver or trustee or an assignee for the benefit of creditors of either party, or in the event of a breach of any other terms hereof, including warranties of Seller, the other party shall be entitled to cancel this Purchase Order forthwith, without liability for loss of anticipated profits.

20. **Integration.** In accepting this Purchase Order or making deliveries hereunder, Seller agrees to all of the terms and conditions stated on this Purchase Order. This Purchase Order, together with any written documents which may be attached hereto, and/or incorporated by specific reference, constitutes the entire agreement between the parties and supersedes all previous communications between them, either oral or written. All such previous communications are hereby abrogated and withdrawn, and no stipulations, representations or agreements by Buyer or any of its officers, agents or employees shall be binding on the Buyer unless reduced to writing and attached to and incorporated in this Purchase Order by reference as above provided and no local, general or trade custom shall alter or vary the terms hereof.

21. **Confidential.** The Seller shall not disclose any details connected with this Purchase Order to any third party except as may be required to insure performance, except as herein specified, without first obtaining the written consent of the Buyer.

22. **Governing Law.** This Purchase Order will be governed by the laws of the State of Utah, except for its conflict of laws rules.

23. **Jurisdiction & Venue.** This Purchase Order will be deemed to have been made, executed and delivered in Salt Lake City, Utah. The courts and authorities of the State of Utah will have exclusive jurisdiction over all controversies which may arise under or in relation to this Purchase Order, the parties hereto hereby consenting to service, jurisdiction, and waiving any other venue to which they might be entitled by virtue of domicile, habitual residence or otherwise.

Seller's Initials_____ **Buyer's Initials**_____

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 2/1/2022

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER AGENT NAME AGENT ADDRESS AGENT PHONE	CONTACT NAME: AGENCY CONTACT PERSON PHONE (A/C, No, Ext): PHONE — FAX (A/C, No): FAX E-MAIL ADDRESS: CONTACT EMAIL
INSURED INSURED NAME INSURED ADDRESS	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : "A-", OR BETTER, "A" RATED CARRIER INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC OTHER:	X	X	POLICY NUMBER	XX/XX/XX	XX/XX/XX	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$1,000,000 $100,000 $5,000 $1,000,000 $2,000,000 $2,000,000 $
A	AUTOMOBILE LIABILITY X ANY AUTO [ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS X HIRED AUTOS [X] NON-OWNED AUTOS	X	X	POLICY NUMBER IF "ANY AUTO" IS NOT CHECKED, THEN ALL THREE OF THE FOLLOWING MUST BE CHECKED: OWNED, HIRED, NON-OWNED.	XX/XX/XX	XX/XX/XX	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$1,000,000 $ $ $ $
	X UMBRELLA LIAB [X] OCCUR EXCESS LIAB [ ] CLAIMS-MADE DED [ ] RETENTION $			POLICY NUMBER	XX/XX/XX	XX/XX/XX	EACH OCCURRENCE AGGREGATE $	$ 2,000,000 $ $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N [ ] (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		POLICY NUMBER	XX/XX/XX	XX/XX/XX	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

PROJECT: Duchesne High School & Sports Complex

WESTLAND CONSTRUCTION, INC., ARCHITECT AND OWNER ARE NAMED AS ADDITIONAL INSUREDS AS RESPECTS TO GENERAL LIABILITY IF REQUIRED BY WRITTEN CONTRACT PER (ENDORSEMENT FORM #). WAIVER OF SUBROGATION AND PER PROJECT AGGREGATE LIMIT OF LIABILITY SHALL APPLY; SUCH INSURANCE AS IS AFFORDED BY THIS POLICY SHALL BE PRIMARY AND NON-CONTRIBUTORY. SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE, 30 DAYS WRITTEN NOTICE (10 DAYS FOR NON-PAYMENT) WILL BE DELIVERED TO THE CERTIFICATE HOLDER.

CERTIFICATE HOLDER

WESTLAND CONSTRUCTION, INC.
ATTN: INSURANCE COORDINATOR
1411 WEST 1250 SOUTH, SUITE 200
OREM, UT 84058
email:akelly@westlandconstruction.com

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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AIA® Document G704® – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:**	**CERTIFICATE INFORMATION:**
Duchesne High School - Phase III 155 W Main Street Duchesne, UT 84021	Contract For: General Construction Date:	Certificate Number: 001 Date:
OWNER: *(name and address)* Duchesne County School District 1010 E 200 N Roosevelt, UT 84066	**ARCHITECT:** *(name and address)* KMA Architects, Inc. 170 North Main Street Spanish Fork, UT 84660	**CONTRACTOR:** *(name and address)* Westland Construction 1411 W 1250 S Orem, UT 84058

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

KMA Architects, Inc.		Wes Christensen, President	
ARCHITECT *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE OF SUBSTANTIAL COMPLETION**

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first.
The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

Westland Construction			
CONTRACTOR *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**
Duchesne County School District		Dee Miles, Business Administator	

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User Notes: (3B9ADA52)

OWNER *(Firm Name)*	SIGNATURE	PRINTED NAME AND TITLE	DATE

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

DRAFT AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

«»« »
«»

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

«»« »
«
»

CONSTRUCTION CONTRACT
Date: «»
Amount: $ «»
Description:
(Name and location)

«»
«
»

BOND
Date:
(Not earlier than Construction Contract Date)
«»
Amount: $ «»
Modifications to this Bond: « » None « » See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: « »
Name and Title: « »« »

SURETY
Company: *(Corporate Seal)*
Signature: « »
Name and Title: « »« »

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:	« »	Signature:	« »
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

DRAFT AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

«»« »
«»

SURETY:
(Name, legal status and principal place of business)

« »« »
« »

OWNER:
(Name, legal status and address)

«»« »
«»

CONSTRUCTION CONTRACT
Date: « »
Amount: $ « »
Description:
(Name and location)

«»
«
»

BOND
Date:
(Not earlier than Construction Contract Date)
« »
Amount: $ « »
Modifications to this Bond: « » None « » See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature: « »

Name and Title: « »« »

SURETY
Company: *(Corporate Seal)*
Signature: « »

Name and Title: « »« »

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

« »
« »
« »

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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User Notes: (3B9ADA3D)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

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§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

« »

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:	« »	Signature:	« »
Name and Title:	« »« »	Name and Title:	« »« »
Address:	« »	Address:	« »

DRAFT

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DIVISION 1 – GENERAL REQUIREMENTS

01 10 00	SUMMARY
01 20 00	PRICE AND PAYMENT PROCEDURES
01 21 00	ALLOWANCES
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01 60 00	PRODUCT REQUIREMENTS
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SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Name: Duchesne High School Phase lll.

B. Owner's Name: Duchesne County School District.

C. Architect's Name: KMA Architects, Inc.

D. Scope of Work: The Project consists of approximately 128,777 sq ft of new construction connecting to the existing building. This new addition will include all standard high school amenities, including remodeling the existing administration area, media center, kitchen and lunchroom area commons, auditorium with drama, choral, and band facilities, a gymnasium, full team and PE locker rooms, a weight/fitness room and wrestling room, wood shop, metal shop, metal shop, and business classrooms. The second story will house standard classrooms. This project will also have mechanical mezzanines to house the mechanical equipment, electrical, and data. The site will be fully developed with parking lots, roads, grass and landscaping areas. There will be one alternate which includes the construction of a new artificial turf football field with new bleachers on the home and visitors side.
   1. Project Location: 155 W Main St, Duchesne, UT 84021

1.03 CONTRACT DESCRIPTION

A. Contract Documents, dated April 2022, were prepared for the Project by KMA Architects, Inc., 170 N. Main Street, Spanish Fork, UT, 84660.

B. Contract Type: The Work will be constructed under a single prime contract.

C. Separate Contract: The Owner reserves the right to have separate contract for performance of certain construction operations at the building and site. Those operations will be conducted simultaneously with work under this Contract.

D. Cooperate fully with separate contractors so that work under those contracts may be carried out smoothly without interfering with or delaying work under this Contract.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

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

B. Construction Operations: Limited to areas within contract limits indicated.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

C. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.

D. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

E. Time Restrictions:
1. Limit conduct of especially noisy, malodorous, and dusty exterior work to the hours of 7:00 a.m. - 10:00 p.m.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Documentation of changes in Contract Sum and Contract Time.

C. Change order procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 50 00 - Contracting Forms and Supplements: Forms to be used.

B. Section 01 21 00 - Allowances: Payment procedures relating to allowances.

1.03 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets, Submittals Schedule, and Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
   8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
      a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

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

1.04 APPLICATIONS FOR PAYMENTS

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

C. Payment Application Forms: Use Form AIA G702 and Form AIA G703 Continuation Sheets as form for Applications for Payment.

D. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

E. Forms filled out by hand will not be accepted.

F. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

G. Execute certification by signature of authorized officer.

H. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

I. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

J. Submit one electronic and three hard-copies of each Application for Payment.

K. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 30 00.
   2. Construction progress schedule, revised and current as specified in Section 01 30 00.

L. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor, on AIA Document G710, "Architect's Supplemental Instructions."

B. Owner-Initiated Proposal Requests: For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time or Contract

Sum for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a estimated price quotation within time specified in proposal request.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

C. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

D. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.06 ALLOWANCES

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

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.07 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue Change Orders for signatures of Owner and Contractor on AIA Document G701.

B. On change orders above and beyond those covered by the Owner's contingency, the allowance for the combined overhead and profit and related bond costs, included in the total cost to the Owner shall be limited to the following schedule:
   1. For the General Contractor and any subcontractors included in the work, the mark-up shall be limited to a total 15% for changes up to $10,000.00.
   2. Changes in excess of $10,000.00 shall have mark-up limited to a total of 10% for the General Contractor and any subcontractors involved in the work.
   3. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.7.
   4. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also.

1.08 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.09 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 29 00

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

1.02 SECTION INCLUDES

A. Lump-sum allowances.

B. Contingency allowances, includes installation.

C. Payment and modification procedures relating to allowances.

1.03 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.04 SELECTION AND PURCHASE

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

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

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

1.05 SUBMITTALS

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

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

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

1.06 COORDINATION

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

1.07 LUMP- SUM ALLOWANCES

A. Costs Included in Lump-sum Allowances: Cost to Contractor or subcontractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site..

B. Costs Not Included in Lump-sum Allowances: Contractor's costs for receiving and product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; labor for installation and finishing; overhead and profit, and similar costs related to products and materials shall be included as part of the Contract Sum and not part of the allowance.

1.08 CONTINGENCY ALLOWANCE

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

B. Contractor's costs for products, delivery, installation, labor, insurance, taxes, equipment rental, overhead, profit, and related costs for products and equipment will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance and are not part of the Contract Sum.

C. Funds will be drawn from the Contingency Allowance only by debit/credit Change Order.

D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.09 UNUSED MATERIALS

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

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit.

PART 2 - PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 DEFINITIONS

A. Coordinate first paragraph below with Section 01 33 00 "Submittal Procedures." Indicate critical dates on both Contractor's construction schedule and submittal schedule.

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

1. The cost or credit of each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

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

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

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. One - Construction of a new artificial turf for the football field with new bleachers on the home and visitors side.

1. Conversion of the existing grass field to synthetic turf with drainage systems and water cannons.
2. New football goal posts, padding and various field accessories.
3. New asphalt d-zones coated with synthetic track surfacing.
4. New long jump runways and sand pits.
5. New "home" and "visitor" grandstands, concrete flatwork with fencing and gates.
6. New shot put throwing pad.
7. New 4' tall track perimeter fencing and gates mounted in a new concrete curb.
8. New 6' high security fencing and gates.
9. New stadium lighting, scoreboard and flagpole.
10. Discus Cage (Located at adjacent field).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
         2) Owner's, Architect's, and Contractor's names.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
         2) Indication of whether the substitution is for cause or convenience.
         3) Issue date.
         4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
         5) Description of Substitution.
         6) Reason why the specified item cannot be provided.
         7) Differences between proposed substitution and specified item.
      c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
         1) Physical characteristics.
         2) In-service performance.
         3) Expected durability.
         4) Visual effect.
         5) Warranties.
         6) Other salient features and requirements.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:

B. Architect will consider requests for substitutions only if submitted at least 2 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Architect will consider requests for substitutions only within 15 days after date of Agreement.

B. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.

C. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Progress meetings.

E. Construction progress schedule.

F. Contractor's daily reports.

G. Field condition reports.

H. Progress photographs.

I. Coordination drawings.

J. Submittals Schedule.

K. Submittals for review, information, and project closeout.

L. Number of copies of submittals.

M. Requests for Interpretation (RFI) procedures.

N. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.

B. Section 01 60 00 - Product Requirements: General product requirements.

C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

1.04 PROJECT COORDINATOR

A. Project Coordinator: General Contractor.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for construction access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for Interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: Shall be selected by contractor and approved by Architect.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and the Contractor is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Schedule meeting at the project site or another convenient location no later than fifteen (15) days after execution of the Agreement.

B. Contractor will schedule a meeting after Notice of Award.

C. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Consultants.
   5. Contractor's Superintendent.
   6. Major Subcontractors.
   7. Suppliers

D. Agenda:
   1. Phasing.
   2. Execution of Owner-Contractor Agreement.
   3. Distribution of Contract Documents.
   4. Designation of personnel representing the parties to Contract, Owner and Architect.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling.
   7. Preparation of Record Documents.
   8. Use of the premises.
   9. Work restrictions.
   10. Responsibility for temporary facilities and controls.
   11. Construction waste management and recycling.
   12. Parking availability.
   13. Office, work, and storage areas.
   14. Equipment deliveries and priorities.
   15. First aid.
   16. Security.
   17. Progress cleaning.
   18. Working hours.

E. Minutes: Contractor and Architect will record and distribute meeting minutes.

3.03 PRE-INSTALLATION CONFERENCES

A. Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
   1. Roofing.
   2. Hardware/keying.
   3. Window installation.
   4. Artificial turf.
   5. Bleacher system.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings at the project site throughout progress of the work at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.

4. Special consultants when required.
5. Contractor's superintendent.
6. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Status of proposal requests, pending changes and change orders.
14. Effect of proposed changes on progress schedule and coordination.
15. Documentation of information for payment requests.
16. Other business relating to work.

E. Record minutes and distribute copies within five days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
1. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule.

3.06 DAILY CONSTRUCTION REPORTS

A. In addition to transmitting electronically a copy to Owner and Architect, submit two printed copies at monthly intervals.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
1. Date.
2. High and low temperatures, and general weather conditions.
3. List of subcontractors at Project site.
4. Major equipment at Project site.
5. Material deliveries.
6. Safety, environmental, or industrial relations incidents.
7. Meetings and significant decisions.
8. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
9. Meter readings and similar recordings.
10. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
11. Services connected and disconnected.
12. Testing and/or inspections performed.
13. List of verbal instruction given by Owner and/or Architect.
14. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 3 days after being taken.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

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

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

G. Preconstruction Photographs: Before commencement of excavation, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag excavation areas before taking construction photographs.
   2. Take the appropriate number of photographs to show existing conditions adjacent to property before starting the Work.
   3. Take the appropriate number of photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

H. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Enclosure of building, upon completion.
   6. Final completion.

I. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.

J. Views:
   1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
   2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   3. Consult with Architect for instructions on views required.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
   5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

K. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
   4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.08 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.09 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Architect.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within fifteen calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule.
   2. Coordinate with Contractor's construction schedule, schedule of values, and other required schedules and reports.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Arrange in chronological order by dates required by construction schedule.
   5. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, role and name of subcontractor, and scheduled date for Architect's final release or approval..
   6. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
   5. Product Schedule or List:.
   6. Submittals Schedule.

7. Application for Payment.
8. Schedule of Values.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.12 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Coordination drawings.
8. Maintenance data.
9. Other types indicated.

B. Number of Copies: Submit one digital copy of each submittal, unless otherwise indicated

C. Submit for Architect's knowledge as contract administrator or for Owner.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.15 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a separate transmittal for each item.
2. Transmit using approved form.
   a. Use form generated by Electronic Document Submittal Service software.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Date; Architect; Contractor; subcontractor; supplier; manufacturer; pertinent drawing and detail number; location where product is to be installed; specification section number and title; and submittal number.

5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, and date of Contractor's approval.
    b. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. Deliver each submittal using one of the following delivery methods on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    a. Send submittals in electronic format via email to Architect.
    b. Upload submittals in electronic form to Electronic Document Submittal Service website.
7. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Provide space for Contractor and Architect review stamps.
10. When revised for resubmission, identify all changes made since previous submission. Note date and content of previous submittal.
11. Distribute reviewed submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms. Instruct parties to promptly report inability to comply with requirements.
12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
13. Submittals not requested will not be recognized or processed.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.
4. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
5. Mark each copy of each submittal to show which products and options are applicable.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
4. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Notation of coordination requirements.
    j. Notation of dimensions established by field measurement.

k. Relationship to adjoining construction clearly indicated.
l. Seal and signature of professional engineer if specified.
m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

D. Samples Procedures:
1. 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.
2. Transmit related items together as single package.
3. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
4. 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 appropriate Specification Section.
5. 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.
6. 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 one 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. Architect shall request additional samples if needed.
7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
a. Number of Samples: Submit one set of Samples. Architect will retain Sample set. Additional sample sets can be requested by Architect.

3.16 SUBMITTAL REVIEW

A. Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

B. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

C. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

D. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

E. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

F. Architect's actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.

1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.

2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit".
      1) Resubmit revised item, with review notations acknowledged and incorporated.
   b. "Rejected".
      1) Submit item complying with requirements of Contract Documents.

G. Architect's actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

H. **NOTE: Submittals reviewed by Contractor and Architect, and marked with Action stamp, does not relieve contractor or supplier submitting of responsibility to comply with contract documents.**

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary: Work sequence, occupancy, and owner-furnished items.

1.03 SUBMITTALS

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule.

B. Submit updated schedule with each Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

F. Indicate delivery dates for owner-furnished products.

G. Coordinate content with schedule of values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

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

H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Final Completion.

F. As the Work progresses, indicate Actual Completion percentage for each activity.

G. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, testing and inspecting agencies, Architect, Owner, and other concerned parties.

B. Issue schedule one week before each regularly scheduled progress meeting. Issue updated schedule concurrently with the report of each such meeting.

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

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

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

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 42 16 - Definitions.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2019).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

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

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.

C. Test Reports: After each test/inspection, promptly submit one digital copy of report to Architect and to Contractor.
   1. Include:
      a. Date issued.

b. Project title and number.
c. Name of inspector.
d. Date and time of sampling or inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, 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.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:
1. Prior to start of work, 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. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.06 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing and inspection.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory: Authorized to operate in Utah.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

3.03 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Notify Architect and Owner seven (7) working days in advance of dates and times when mock-ups will be constructed.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within five (5) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

J. Where possible salvage and recycle the demolished mock-up materials.

3.04 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.05 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.06 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.07 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 42 16
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

B. Directed: A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

C. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

D. Furnish: To supply, deliver, unload, and inspect for damage.

E. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

F. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

G. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

H. Provide: To furnish and install.

I. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work

J. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary telecommunications services.

D. Temporary sanitary facilities.

E. Temporary Controls: Barriers, enclosures, and fencing.

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.04 DEWATERING

A. Comply with requirements of authorities having jurisdiction. Provide temporary means and methods for dewatering all temporary facilities and controls.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

B. Maintain temporary facilities as directed by Architect.

1.05 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Existing facilities may be used.

C. New permanent facilities may be used.

1.06 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. Telephone Land Lines: One line for each field office; one handset per line.
   2. Internet Connections: Minimum of one; high speed internet connection or faster.
   3. Email: Account/address reserved for project use.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.08 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

E. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

1.09 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

C. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

D. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

1.10 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.11 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.12 TEMPORARY FIRE PROTECTION

A. Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

B. Prohibit smoking.

C. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

1.13 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.14 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.15 WASTE REMOVAL

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.16 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. Provide temporary, directional signs for construction personnel and visitors.

D. No other signs are allowed without Owner permission except those required by law.

1.17 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures. Provide incombustible construction for offices, shops, and sheds. Comply with NFPA 241.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to owner.

C. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

D. Clean and repair damage caused by installation or use of temporary work.

E. Restore existing facilities used during construction to original condition.

F. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Identification of Owner-supplied products.

B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

D. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.05 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Warranty in first subparagraph below is manufacturer's standard and may have exclusions and limitations that do not suit Project. Check warranties and specify special warranties if manufacturers' warranties are not suitable.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
    a. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

2. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
    a. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
    b. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
    c. Refer to individual divisions for specific content requirements and particular requirements for submitting special warranties.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Where other criteria are met, Contractor shall give preference to products that:
    1. If used on interior, have lower emissions, as defined in Section 01 61 16.
    2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
    1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
    2. Arrange and pay for product delivery to site.
    3. On delivery, inspect products jointly with Contractor.
    4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
    5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
    1. Review Owner reviewed shop drawings, product data, and samples.
    2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

I. Comply with manufacturer's warranty conditions, if any.

J. Do not store products directly on the ground.

K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

M. Prevent contact with material that may cause corrosion, discoloration, or staining.

N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.

C. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

D. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

E. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

F. Section 07 84 00 - Firestopping.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:

a. Identification of Project.
b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Effect on work of Owner or separate Contractor.
f. Written permission of affected separate Contractor.
g. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For surveying work, employ a land surveyor registered in Utah and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Utah. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Utah.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.
2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.
4. Controlling lines and levels required for mechanical and electrical trades.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent

finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Remove malfunctioning units, replace with new units, and retest.

C. Notify Architect and Owner prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage. Replace damaged and malfunctioning controls and equipment.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and other limited access spaces.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Manager on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Owner will occupy all of the building as specified in Section 01 10 00.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Accompany Project Manager on Contractor's preliminary final inspection.

I. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

J. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
   6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

E. Section 31 10 00 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit Waste Management Plan within 30 days of date established for commencement of the Work; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

C. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
      a. List each material proposed to be salvaged, reused, or recycled.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards (cubic meters).
      c. Include weight tickets as evidence of quantity.
   7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 60 00 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 10 00 for list of items to be salvaged from the existing building for relocation in project or for Owner.

B. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

D. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

E. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   3. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
   4. Locate enclosures out of the way of construction traffic.
   5. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   6. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   7. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned within 15 days after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   2. Submit three sets of revised final documents in final form within 15 days of receipt of Architect's comments.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawingsand Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

3.03 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.04 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.05 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Manufacturer's name, product name, model number, and serial number.
   3. Identify function, normal operating characteristics, and limiting conditions.
   4. Include performance curves, with engineering data and tests.
   5. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
   1. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

M. Include test and balancing reports.

N. Additional Requirements: As specified in individual product specification sections.

3.06 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Contractor has the option to organize a **digital copy** in the same order and requirements as a physical binder as follows.

B. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

C. Where systems involve more than one specification section, provide separate tabbed divider for each system.

D. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.

d. Field quality control data.
e. Photocopies of warranties and bonds.

3.07 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. List circumstances and conditions that would affect validity of warranties or bonds.

F. Manual: Contractor to provide **digital copy** or physically bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

J. An organized digital copy of the warranties may be submitted along with hard copy binder.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use. Submit within seven days of end of each training module.
   1. Format: Provide high-quality color MP4, WMV, or AVI formats.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Schedule training with Owner, through Architect, with at least seven days' advance notice. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. For equipment that requires seasonal operation, provide similar instruction at start of each season.

I. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

J. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

K. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

L. Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

M. Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION

DIVISION 2 – SITE WORK

02 32 00	GEOTECHNICAL INVESTIGATION
02 41 00	DEMOLITION

SECTION 02 32 00
GEOTECHNICAL INVESTIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Geotechnical Study prepared by Earthtec Engineering.

1.2 REPORT

A. Report dated February 5, 2020, is included at the end of this section.

END OF SECTION

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Lindon, Utah - 84042
Phone (801) 225-5711

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Salt Lake City, Utah - 84104
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Phone (801) 399-9516

Geotechnical Study
Duchesne High School
155 West Main Street
Duchesne, Utah

Project No. 199085

February 5, 2020



Prepared For:

Duchesne County School District
Attention: Mr. Michael Weldon
1010 East 200 North
Roosevelt, UT 84066

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1.0 SUMMARY

This entire report presents the results of Earthtec Engineering's completed geotechnical study for the Duchesne High School in Duchesne, Utah. This summary provides a general synopsis of our recommendations and findings. Details of our findings, conclusions, and recommendations are provided within the body of this report.

- The native soils have a slight to moderate potential for collapse (settlement) and a slight potential for compression under increased moisture contents and anticipated load conditions. (see Section 6)
- Conventional strip and spread footings may be used to support the structures, with foundations placed entirely on a minimum of 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils for structural loads up to 7,000 pounds per linear foot for bearing walls and up to 50,000 pounds for column loads. If loads exceed these see Section 10 for further recommendations.

Based on the results of our field exploration, laboratory testing, and engineering analyses, it is our opinion that the subject site may be suitable for the proposed development, provided the recommendations presented in this report are followed and implemented during design and construction.

Failure to consult with Earthtec Engineering (Earthtec) regarding any changes made during design and/or construction of the project from those discussed herein relieves Earthtec from any liability arising from changed conditions at the site. We also strongly recommend that Earthtec observes the building excavations to verify the adequacy of our recommendations presented herein, and that Earthtec performs materials testing and special inspections for this project to provide continuity during construction.

2.0 INTRODUCTION

The project is located at approximately 155 West Main Street in Duchesne, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map* and Figure No. 2, *Site Plan Showing Location of Borings*, at the end of this report. The purposes of this study are to evaluate the subsurface soil conditions at the site, assess the engineering characteristics of the subsurface soils, and provide geotechnical recommendations for general site grading and the design and construction of foundations, concrete floor slabs, miscellaneous concrete flatwork, and asphalt paved parking and drive areas.

The scope of work completed for this study included field reconnaissance, subsurface exploration, field and laboratory soil testing, geotechnical engineering analysis, and the preparation of this report.

3.0 PROPOSED CONSTRUCTION

We understand that the proposed project, as described to us by Mr. John Shepherd with KMA Architects, consists of constructing a new addition to the high school. The proposed structure will consist of a CMU, one- to two-story, slab-on-grade building. We have based our recommendations in this report that the anticipated foundation loads for the proposed structures will not exceed 7,000 pounds per linear foot for bearing walls, 200,000 pounds for column loads, and 100 pounds per square foot for floor slabs. If structural loads will be greater Earthtec should be notified so that we may review our recommendations and make modifications, if necessary.

In addition to the construction described above, we anticipate that utilities will be installed to service the proposed buildings, exterior concrete flatwork will be placed in the form of curb, gutter, and sidewalks, and asphalt paved parking and drive areas will be constructed.

4.0 GENERAL SITE DESCRIPTION

4.1 Site Description

At the time of our subsurface exploration the site was a developed parcel vegetated with grass. The ground surface appears to be relatively flat, we anticipate less than 3 feet of cut and fill may be required for site grading. The lot was bounded on the north by undeveloped land and residences, on the east by developed land, on the south by Main Street, and on the west by residences.

4.2 Geologic Setting

The surficial geology of much of the area has been mapped by Sprinkel, 2018[1]. The surficial geology at the location of the subject site and adjacent properties is mapped as "Mixed alluvium and colluvium" (Map Unit Qac). These soil or deposits are generally described in the referenced mapping as "silt, sand and gravel." A geologic hazard study was not performed for the subject site during this study.

5.0 SUBSURFACE EXPLORATION

5.1 Soil Exploration

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on January 15, 2020 by the boring of seven (7) borings to depths of 6 to 12½ feet below the existing ground surface using a a truck-mounted hydraulic drill rig. The approximate locations of the borings are shown on Figure No. 2, *Aerial Photograph Showing Location of Borings*. Graphical representations and detailed descriptions of the soils encountered

[1] Sprinkel, D.A., 2018, Interim Geologic Map of the Duchesne 30' x 60' Quadrangle, Duchesne and Wasatch Counties, Utah; Utah Geological Survey, Open-File Report OFR-689, Scale 1: 62,500.

are shown on Figure Nos. 3 through 9, *Boring Log* at the end of this report. The stratification lines shown on the logs represent the approximate boundary between soil units; the actual transition may be gradual. Due to potential natural variations inherent in soil deposits, care should be taken in interpolating between and extrapolating beyond exploration points. A key to the symbols and terms on the logs is presented on Figure No. 10, *Legend*.

Samples of the subsurface soils were collected in the borings at depth intervals of approximately 2½ to 5 feet. Relatively undisturbed samples were collected by pushing thin-walled "Shelby" tubes into undisturbed soils below the augers. Disturbed samples were collected with a 1⅜ inch inside diameter split spoon sampler. The split spoon sampler was driven 18 inches into undisturbed soil with a 140-pound hammer free-falling through a distance of 30 inches. The blows required to drive the sampler through the final 12 inches of penetration is called the "N-value" or "blow count," and is recorded as "blows per foot" on the attached boring logs at the respective sample depths. The blows for each 6-inch interval (or less) are noted on the logs when more than 50 blows per 6 inches (or less) of sampler driving were achieved. The blow count provides a reasonable indication of the in-place relative density of sandy soils but provides only a limited indication of the relative stiffness of cohesive (clayey) materials, since the penetration resistance for these soils is a function of the moisture content. In gravelly soils, the blow count may be higher than it otherwise would be, particularly when one or more gravel particles are larger than the sampler diameter.

The soil samples collected were classified by visual examination in the field following the guidelines of the Unified Soil Classification System (USCS). The samples were transported to our Lindon, Utah laboratory where they will be retained for 30 days following the date of this report and then discarded, unless a written request for additional holding time is received prior to the 30-day limit.

6.0 LABORATORY TESTING

Representative soil samples collected during our field exploration were tested in the laboratory to assess pertinent engineering properties and to aid in refining field classifications, if needed. Tests performed included natural moisture content, dry density tests, liquid and plastic limits determinations, mechanical (partial) gradation analyses, and one-dimensional consolidation tests. The laboratory test results are also included on the attached *Boring Logs* at the respective sample depths, and on Figure Nos. 11 through 14, *Consolidation-Swell Test.*

As part of the consolidation test procedure, water was added to the samples to assess moisture sensitivity when the samples were loaded to an equivalent pressure of approximately 1,000 psf. The native clay soils have a slight to moderate potential for collapse (settlement) and a slight potential for compressibility under increased moisture contents and anticipated load conditions.

A water-soluble sulfate test was performed on a representative sample obtained during our field exploration which indicated a value of 85 parts per million. Based on this result, the risk of sulfate attack to concrete appears to be "negligible" according to American Concrete Institute standards.

Therefore, there are no restrictions on the type of Portland cement that may be used for concrete in contact with on-site soils. The results can be found in Appendix A.

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered fill and topsoil which is estimated to extend about up to 2½ feet in depth at the boring locations. Below the fill and topsoil we encountered layers of clay, sand and gravel extending to depths of 6 to 12½ feet below the existing ground surface. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 9, *Boring Log* at the end of this report. Based on our experience and observations during field exploration, the clay soils ranged from medium stiff to stiff in consistency and the sand and gravel soils had a relative density varying from medium dense to very dense.

It should be considered that a limited number of small diameter soil borings were used during the course of our subsurface exploration. Topsoil and fill material composition and contacts are difficult to determine from boring sampling. Variation in topsoil and fill depths may occur at the site.

7.2 Collapsible Soils

Collapsible soils are typically characterized by a pinhole structure and relatively low unit weights. Foundations, floor slabs, and roadways supported on these soils may be susceptible to large settlements and structural distress when wetted. Collapsible soils were not encountered in our explorations.

In general, the development can be completed if special precautions are taken to minimize the potential for collapse of these soils. In areas where isolated open sidewalks, driveways, and pavements will be constructed, if properly prepared, the moisture sensitive soils may be allowed to remain in place if some settlement can be tolerated. In addition, measures to limit surface water from wetting supporting soils beneath foundations and floor slabs shall be implemented. These measures include maintaining positive surface drainage away from the structures, downspouts should discharge away from foundations or be conveyed to suitable locations down gradient from the structures, minimizing landscape irrigation adjacent to structures, and ensuring proper and adequate compaction of foundation wall backfill.

Depending on the level of risk the owner is willing to assume, several alternatives may be considered to reduce the risk of settlement to the proposed structures. These alternatives include, but are not limited to:

- Removal of the collapsible soils and the establishment of the footings directly upon the underlying non-collapsible soils. Structurally supported floors and/or crawl space construction may be utilized.

- Removal and replacement of the collapsible soils with structural fill and establishing the footings and floor slabs directly upon the structural fill.

7.3 Groundwater Conditions

Groundwater was encountered at depths of approximately 7½ to 8 feet below the existing ground surface. Note that groundwater levels will fluctuate in response to the season, precipitation, snow melt, irrigation, and other on and off-site influences. Quantifying these fluctuations would require long term monitoring, which is beyond the scope of this study. The contractor should be prepared to dewater excavations as needed.

8.0 SITE GRADING

8.1 General Site Grading

All surface vegetation and unsuitable soils (such as topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, collapsible, and any other inapt materials) should be removed from below foundations, floor slabs, exterior concrete flatwork, and pavement areas. We encountered fill and topsoil on the surface of the site. The fill encountered on the site is considered undocumented (untested). The fill and topsoil (including soil with roots larger than about ¼ inch in diameter) should be completely removed, even if found to extend deeper, along with any other unsuitable soils that may be encountered. Over-excavations below footings and slabs also may be needed, as discussed in Section 10.0.

Fill placed over large areas, even if only a few feet in depth, can cause consolidation in the underlying native soils resulting in settlement of the fill. Because the site is relatively flat, we anticipate that less than 3 feet of grading fill will be placed. If more than 3 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may provide additional recommendations, if required. Such recommendations will likely include placing the fill several weeks (or possibly more) prior to construction to allow settlement to occur.

8.2 Temporary Excavations

Temporary excavations that are less than 4 feet in depth and above groundwater should have side slopes no steeper than ½H:1V (Horizontal:Vertical). Temporary excavations where water is encountered in the upper 4 feet or that extend deeper than 4 feet below site grades should be sloped or braced in accordance with OSHA[2] requirements for Type C soils.

8.3 Fill Material Composition

The native clay and sand soils are not suitable for use as placed and compacted engineered fill. Excavated soils, including clay, may be stockpiled for use as fill in landscape areas.

[2] OSHA Health and Safety Standards, Final Rule, CFR 29, part 1926.

Structural fill is defined as imported fill material that will ultimately be subjected to any kind of structural loading, such as those imposed by footings, floor slabs, pavements, etc. Gradation requirements stated below shall be verified in intervals not exceeding 1,000 tons. We recommend that imported structural fill consist of sandy/gravelly soils meeting the following requirements in the table below:

Table 1: Imported Structural Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
4 inches	100
3/4 inches	70 – 100
No. 4	40 – 80
No. 40	15 – 50
No. 200	0 – 20
Liquid Limit	35 maximum
Plasticity Index	15 maximum

Engineered fill is defined as reworked native material that will ultimately be subjected to any kind of structural loading, such as those imposed by footings, floor slabs, pavements. We recommend that a professional engineer or geologist verify that the engineered fill to be used on this project meets the requirements. Engineered fill should be clear of all organics, have a maximum particle size of 4 inches, less than 70 percent retained on the ¾-seive, a maximum Liquid Limit of 35, and a maximum Plasticity Index of 15.

In some situations, particles larger than 4 inches and/or more than 30 percent coarse gravel may be acceptable but would likely make compaction more difficult and/or significantly reduce the possibility of successful compaction testing. Consequently, stricter quality control measures than normally used may be required, such as using thinner lifts and increased or full-time observation of fill placement.

We recommend that utility trenches below any structural load be backfilled using structural fill or engineered fill. Local governments or utility companies required specification for backfill should be followed unless our recommendations stricter.

If native soil is used as fill material, the contractor should be aware that native clay and silt soils (as observed in the explorations) may be time consuming to compact due to potential difficulties in controlling the moisture content needed to obtain optimum compaction and changes proctor values.

If required (i.e. fill in submerged areas), we recommend that free draining granular material (clean sand and/or gravel) meet the following requirements in the table below:

Table 2: Free-Draining Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
3 inches	100
No. 10	0 – 25
No. 40	0 – 15
No. 200	0 – 5
Plasticity Index	Non-plastic

Three-inch minus washed rock (sometimes called river rock or drain rock) and pea gravel materials usually meet these requirements and may be used as free draining fill. If free draining fill will be placed adjacent to soil containing a significant amount of sand or silt/clay, precautions should be taken to prevent the migration of fine soil into the free draining fill. Such precautions should include either placing a filter fabric between the free draining fill and the adjacent soil material, or using a well-graded, clean filtering material approved by the geotechnical engineer.

8.4 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness prior to compaction of 4 inches for hand operated equipment, 6 inches for most "trench compactors" and 8 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the following percentages of the maximum dry density, as determined by ASTM D-1557:

- In landscape and other areas not below structurally loaded areas: 90%
- Less than 5 feet of fill below structurally loaded areas: 95%
- 5 feet or greater of fill below structurally loaded areas: 98%

Generally, placing and compacting fill at moisture contents within ±2 percent of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. Typically, the further the moisture content deviates from optimum the more difficult it will be to achieve the required compaction.

Fill should be tested frequently during placement and we recommend early testing to demonstrate that placement and compaction methods are achieving the required compaction. The contractor is responsible to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

8.5 Stabilization Recommendations

Near surface soils may rut and pump during grading and construction. The likelihood of rutting and/or pumping, and the depth of disturbance, is proportional to the moisture content in the soil, the load applied to the ground surface, and the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the ground surface by using lighter equipment, partially loaded equipment, tracked equipment, by working in dry times of the year, and/or by providing a working surface for equipment.

During grading the soil in any obvious soft spots should be removed and replaced with granular material. If rutting or pumping occurs traffic should be stopped in the area of concern. The soil in rutted areas should be removed and replaced with granular material. In areas where pumping occurs the soil should either be allowed to sit until pore pressures dissipate (several hours to several days) and the soil firms up or be removed and replaced with granular material. Typically, we recommend removal to a minimum depth of 24 inches.

For granular material, we recommend using angular well-graded gravel, such as pit run, or crushed rock with a maximum particle size of four inches. We suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor. A finer granular material such as sand, gravelly sand, sandy gravel or road base may also be used. Materials which are more angular and coarse may require thinner lifts in order to achieve compaction. We recommend that the fines content (percent passing the No. 200 sieve) be less than 15%, the liquid limit be less than 35, and the plasticity index be less than 15.

Using a geosynthetic fabric, such as Mirafi 600X or equivalent, may also reduce the amount of material required and avoid mixing of the granular material and the subgrade. If a fabric is used, following removal of disturbed soils and water, the fabric should be placed over the bottom and up the sides of the excavation a minimum of 24 inches. The fabric should be placed in accordance with the manufacturer's recommendations, including proper overlaps. The granular material should then be placed over the fabric in compacted lifts. Again, we suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor.

9.0 SEISMIC AND GEOLOGIC CONSIDERATIONS

9.1 Seismic Design

The State of Utah has adopted the 2018 International Building Code (IBC) for seismic design and the structure should be designed in accordance with Chapter 16 of the IBC. Considering our experience in the vicinity of the site and based on the results of our field exploration, we recommend using Site Class D.

The site is located at approximately 40.164 degrees latitude and -110.405 degrees longitude. Using Site Class D, the design spectral response acceleration parameters are given below.

Table 3: Design Accelerations

S_S	F_a	S_{MS}	S_{DS}	S_1
0.316 g	1.547	0.489 g	0.326 g	0.099 g

9.2 Faulting

The subject property is located within the Intermountain Seismic Belt where the potential for active

faulting and related earthquakes is present. Based upon published geologic maps[3], no active faults traverse through or immediately adjacent to the site and the site is not located within local fault study zones. The nearest mapped fault trace is the Duchesne-Pleasant Valley fault system located 3 miles south of the site.

9.3 Liquefaction Potential

Liquefaction can occur when saturated subsurface soils below groundwater lose their inter-granular strength due to an increase in soil pore water pressures during a dynamic event such as an earthquake. Loose, saturated sands are most susceptible to liquefaction, but some loose, saturated gravels and relatively sensitive silt to low-plasticity silty clay soils can also liquefy during a seismic event. Subsurface soils encountered were composed of unsaturated and saturated clay, sand and gravel soils.

The soils encountered at this project do not appear liquefiable, but the liquefaction susceptibility of underlying soils (deeper than our explorations) is not known and would require deeper explorations to quantify.

10.0 FOUNDATIONS

10.1 General

The foundation recommendations presented in this report are based on the soil conditions encountered during our field exploration, the results of laboratory testing of samples of the native soils, the site grading recommendations presented in this report, and the foundation loading conditions presented in Section 3.0, *Proposed Construction*, of this report. If loading conditions and assumptions related to foundations are significantly different, Earthtec should be notified so that we can re-evaluate our design parameters and estimates (higher loads may cause more settlement), and to provide additional recommendations if necessary.

Conventional strip and spread footings may be used to support the proposed structures after appropriate removals as outlined in Section 8.1. Foundations should not be installed on topsoil, undocumented fill, debris, combination soils, organic soils, frozen soil, or in ponded water. If foundation soils become disturbed during construction, they should be removed or compacted.

10.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on a minimum of 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils for structural loads up to 7,000 pounds per linear foot for bearing walls and up to 50,000 pounds for column loads. If loads exceed 7,000 pounds per linear foot for bearing walls or 50,000 pounds for column loads specified structural fill depths are below.

[3] U.S. Geological Survey, Quaternary Fault and Fold Database of the United States, November 3, 2010.

Table 4: Depth of Structural Fill

Structural Load (kips)	Depth of Structural Fill (in)
Up to 50	18
50 – 100	30
100 – 200	42

For foundation design we recommend the following:

- Footings founded on a minimum of 18 inches of structural fill may be designed using a maximum allowable bearing capacity of 2,000 pounds per square foot. The values for vertical foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2018 International Building Code.
- Continuous and spot footings should be uniformly loaded and should have a minimum width of 20 and 30 inches, respectively.
- Exterior footings should be placed below frost depth which is determined by local building codes. In general, 30 inches of cover is adequate for most sites; however local code should be verified by the end design professional. Interior footings, not subject to frost (heated structures), should extend at least 18 inches below the lowest adjacent grade.
- Foundation walls and footings should be properly reinforced to resist all vertical and lateral loads and differential settlement.
- The bottom of footing excavations should be compacted with at least 4 passes of an approved non-vibratory roller prior to erection of forms or placement of structural fill to densify soils that may have been loosened during excavation and to identify soft spots. If soft areas are encountered, they should be stabilized as recommended in Section 8.5.
- Footing excavations should be observed by the geotechnical engineer prior to beginning footing construction to evaluate whether suitable bearing soils have been exposed and whether excavation bottoms are free of loose or disturbed soils.
- Structural fill used below foundations should extend laterally a minimum of 6 inches for every 12 vertical inches of structural fill placed. For example, if 18 inches of structural fill is required to bring the excavation to footing grade, the structural fill should extend laterally a minimum of 9 inches beyond the edge of the footings on both sides.

10.3 Estimated Settlements

If the proposed foundations are properly designed and constructed using the parameters provided above, we estimate that total settlements should not exceed one inch and differential settlements should be one-half of the total settlement over a 25-foot length of continuous foundation, for non-earthquake conditions. Additional settlement could occur during a seismic event due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, if loading

conditions are greater than anticipated in Section 2, and/or if foundation soils are allowed to become wetted.

10.4 Lateral Load Resistance

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.55 for structural fill meeting the recommendations presented herein. The values for lateral resistance can be increased by one-third for wind and seismic conditions per Section 1806 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2018 International Building Code.

11.0 FLOOR SLABS AND FLATWORK

Concrete floor slabs and exterior flatwork may be supported on undisturbed native soils or on a minimum of 12 inches properly placed, compacted, and tested engineered fill or imported structural fill extending to undisturbed native soils after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum of 4 inches of free-draining fill material (see Section 8.3) beneath floor slabs to facilitate construction, act as a capillary break, and aid in distributing floor loads. For exterior flatwork, we recommend placing a minimum of 4 inches of road-base material. Prior to placing the free-draining fill or road-base materials, the native sub-grade should be proof-rolled to identify soft spots, which should be stabilized as discussed above in Section 8.5.

For slab design, we recommend using a modulus of sub-grade reaction of 120 pounds per cubic inch. The thickness of slabs supported directly on the ground shall not be less than 3½ inches. A 6-mil polyethylene vapor retarder with joints lapped not less than 6 inches shall be placed between the ground surface and the concrete, as per Section 1907.1 of the 2018 International Building Code.

To help control normal shrinkage and stress cracking, we recommend that floor slabs have adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints, frequent crack control joints, and non-rigid attachment of the slabs to foundation and bearing walls. Special precautions should be taken during placement and curing of all concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and practices.

12.0 DRAINAGE

12.1 Surface Drainage

Due to the collapse potential of native soils, wetting of subsurface soils (including those below foundations) could result in adverse settlement. Accordingly, we recommend the following:

- The contractor should take precautions to prevent significant wetting of the soil at the base of the excavation. Such precautions may include: grading to prevent runoff from entering the excavation, excavating during normally dry times of the year, covering the base of the excavation if significant rain or snow is forecast, backfill at the earliest possible date, frame floors and/or the roof at the earliest possible date, other precautions that might become evident during construction.
- Adequate compaction of foundation wall backfill must be provided i.e. a minimum of 90% of ASTM D-1557. Water consolidation methods should not be used.
- The ground surface should be graded to drain away from the building in all directions. We recommend a minimum fall of 8 inches in the first 10 feet.
- Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.
- Sprinkler nozzles should be aimed away, and all sprinkler components kept at least 5 feet, from foundation walls. A drip irrigation system may be utilized in landscaping areas within 10 feet of foundation walls to minimize water intrusion at foundation backfill. Also, sprinklers should not be placed at the top or on the face of slopes. Sprinkler systems should be designed with proper drainage and well maintained. Over-watering should be avoided.
- Any additional precautions which may become evident during construction.

12.2 Subsurface Drainage

Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall conform to Section 1805 of the 2018 International Building Code for damp proofing and water proofing.

13.0 PAVEMENT RECOMMENDATIONS

We understand that asphalt paved parking and drive areas and bus loading/unloading areas will be constructed as part of the project. The native soils encountered beneath the fill and topsoil during our field exploration were predominantly composed of clays. We estimate that a California Bearing Ratio (CBR) value of 3 is appropriate for these soils. Also, the near-surface native clay/silt soils are potentially collapsible, and over-excavation may be needed to minimize the potential settlement of pavements. If the fill and topsoil is left beneath concrete flatwork and pavement

areas, increased maintenance costs over time should be anticipated.

For heavy duty areas, we anticipate that the traffic volume will be about 200 vehicles per day (7.9 ESAL/day) or less for the drive areas, consisting of mostly cars and pickup trucks, with a daily delivery truck, and 10 buses. Based on these traffic parameters, the estimated CBR given above, a 20-year life expectancy, and the procedures and typical design inputs outlined in the UDOT Pavement Design Manual (2008), we recommend the minimum asphalt pavement section presented below.

Table 5: Heavy Duty Pavement Section Recommendations

Asphalt Thickness (in)	Compacted Aggregate Base Thickness (in)	Compacted Subbase Thickness (in)
3	6	12*
3	16*	0
4	12*	0

* Stabilization may be required

For light duty areas, we anticipate that the traffic volume will be about 100 vehicles per day (1.5 ESAL/day) or less for the parking areas, consisting of mostly cars and pickup trucks, with a daily delivery truck and a weekly garbage truck. Based on these traffic parameters, the estimated CBR given above, a 20-year life expectancy, and the procedures and typical design inputs outlined in the UDOT Pavement Design Manual (2008), we recommend the minimum asphalt pavement section presented below.

Table 6: Light Duty Pavement Section Recommendations

Asphalt Thickness (in)	Compacted Aggregate Base Thickness (in)	Compacted Subbase Thickness (in)
3	6	6*
3	10*	0

* Stabilization may be required

If the pavement will be required to support excessive construction traffic (such as dump trucks hauling soil to raise or lower the site), more than an occasional semi-tractor or fire truck, or more traffic than listed above, our office should be notified so that we can re-evaluate the pavement section recommendations. The following also apply:

- The subgrade should be prepared by proof rolling to a firm, non-yielding surface, with any identified soft areas stabilized as discussed above in Section 8.5.
- Site grading fills below the pavements should meet structural fill composition and placement recommendations per Sections 8.3 and 8.4 herein.
- Asphaltic concrete, aggregate base and sub-base material composition should meet local, APWA, or UDOT requirements. Gradation requirements and frequency shall be followed as required by local, APWA, or UDOT requirements, but not to exceed 500 tons.

- Aggregate base and sub-base is compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D 1557).
- The aggregate base shall have a CBR value to 70 percent or greater and the subbase shall have a CBR value of 10 percent or greater.
- Asphaltic concrete is compacted to local or UDOT requirements, or to at least 96 percent of the laboratory Marshall density (ASTM D 6927).

Due to high static loads imposed by at bus loading and unloading areas and at dumpster locations, we recommend that a rigid pavement section for this area of a minimum of six (6) inches of Portland Cement Concrete (PCC) over a minimum of eight (8) inches of aggregate base material. The aggregate base material should meet local, APWA or UDOT requirements and should be compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D1557).

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The explorations may not be indicative of subsurface conditions outside the study area or between points explored and thus have a limited value in depicting subsurface conditions for contractor bidding. Variations from the conditions portrayed in the explorations may occur and which may be sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, Earthtec should be advised immediately so that the appropriate modifications can be made.

The findings and recommendations presented in this geotechnical report were prepared in accordance with generally accepted geotechnical engineering principles and practice in this area of Utah at this time. No warranty or representation is intended in our proposals, contracts, letters, or reports. Failure to consult with Earthtec regarding any changes made during design and/or construction of the project from those discussed herein relieves Earthtec from any liability arising from changed conditions at the site.

This geotechnical report is based on relatively limited subsurface explorations and laboratory testing. Subsurface conditions may differ in some locations of the site from those described herein, which may require additional analyses and possibly modified recommendations. Thus, we strongly recommend consulting with Earthtec regarding any changes made during design and construction of the project from those discussed herein. Failure to consult with Earthtec regarding any such changes relieves Earthtec from any liability arising from changed conditions at the site.

To maintain continuity, Earthtec should also perform materials testing and special inspections for this project. The recommendations presented herein are based on the assumption that an adequate program of tests and observations will be followed during construction to verify compliance with our recommendations. We also assume that we will review the project plans and specifications to verify that our conclusions and recommendations are incorporated and remain

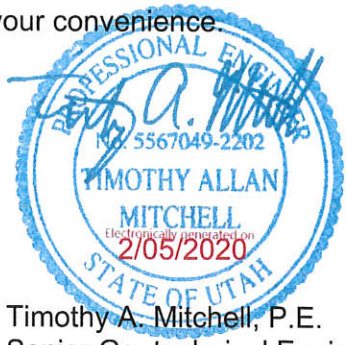
appropriate (based on the actual design). Earthtec should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Earthtec also should be retained to provide observation and testing services during grading, excavation, foundation construction, and other earth-related construction phases of the project.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please contact Earthtec at your convenience.

Respectfully;

EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer



Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

VICINITY MAP

DUCHESNE HIGH SCHOOL
155 WEST MAIN STREET
DUCHESNE, UTAH



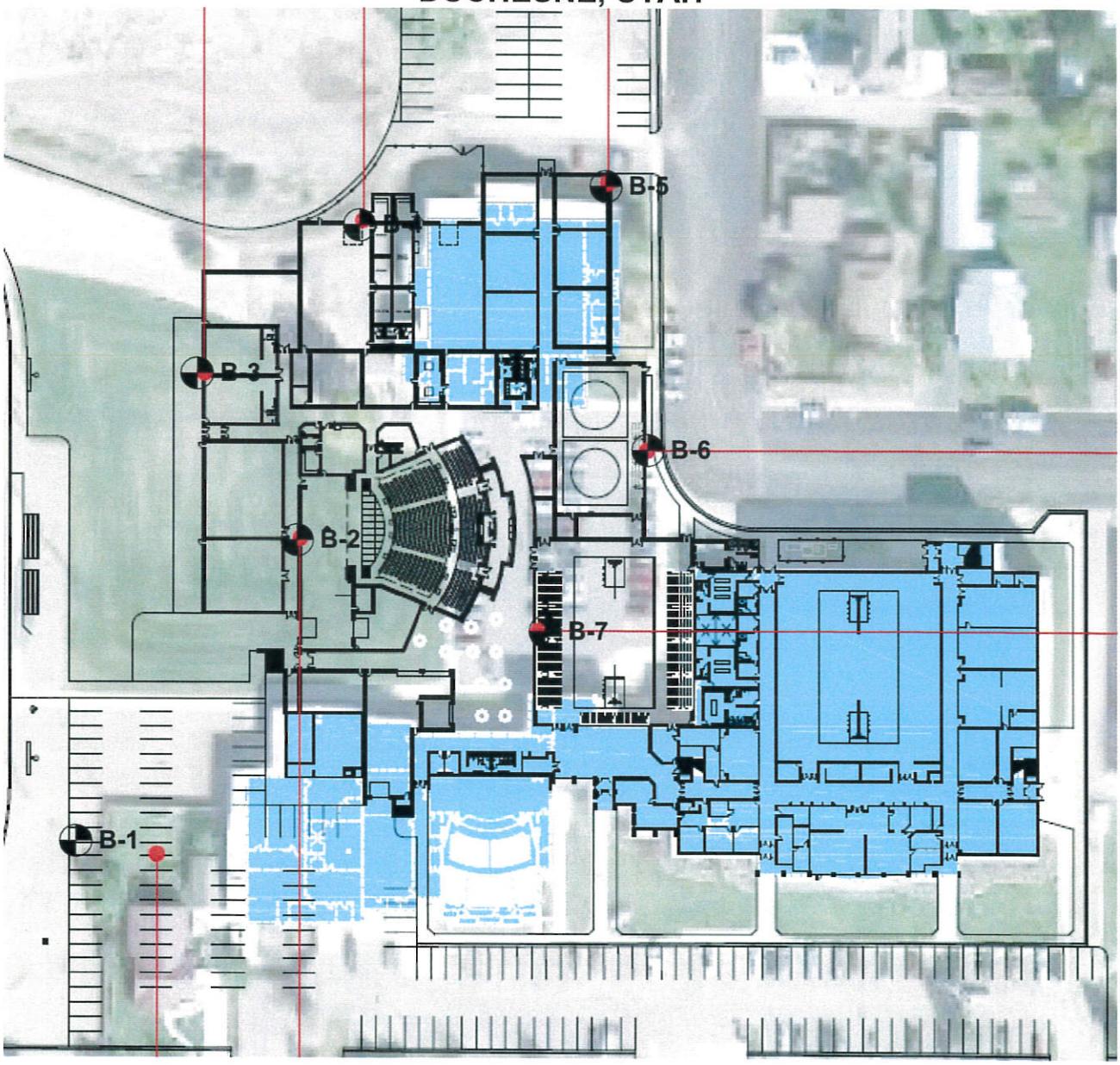
N

Not to Scale

PROJECT NO.: 199085	EARTHTEC ENGINEERING	FIGURE NO.: 1

SITE PLAN SHOWING LOCATION OF BORINGS

DUCHESNE HIGH SCHOOL
155 WEST MAIN STREET
DUCHESNE, UTAH



*Site Plan provided by Client.

Approximate Boring Locations

N

Not to Scale

PROJECT NO.: 199085	EARTHTEC ENGINEERING	FIGURE NO.: 2

BORING LOG

NO.: B-1

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ : 7.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			FILL, gravel, dry, brown										
			Lean CLAY, medium stiff to stiff, moist, brown										
3		CL			7	23		29	9	1	13	86	
6					15								
			Silty GRAVEL with sand, very dense, wet, brown		52								
9		GM											
					50-4½"								
			Maximum depth explored approximately 11 feet due to refusal										
12													
15													

Notes: Groundwater encountered at approximately 7½ feet.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 3

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG
NO.: B-2

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ : 8 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			TOPSOIL, sandy lean clay, moist, brown										
			Silty SAND, loose, moist, brown										
3		SM				11	107	17	2	5	51	44	C
6					8								
		CL	▼Lean CLAY, medium stiff (estimated), moist, brown			30	92	32	12	0	8	92	C
9		GM	Silty GRAVEL with sand, very dense, wet, brown										
					50-5"								
		SM	Silty SAND with gravel, very dense, wet, brown, cemented										
12					74-10½"								
			Maximum depth explored approximately 12½ feet due to refusal										
15													

Notes: Groundwater encountered at approximately 8 feet.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 4

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG
NO.: B-3

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ : 7.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			TOPSOIL, sandy lean clay, moist, brown										
			Lean CLAY, medium stiff, moist, brown										
3		CL			7								
6						31	89	46	21	0	8	92	C
9		GM	Silty GRAVEL with sand, very dense, wet, brown		81								
					50-5"								
12			Maximum depth explored approximately 10½ feet due to refusal										
15													

Notes: Groundwater encountered at approximately 7½ feet.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 5

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG

NO.: B-4

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			FILL, ~3" asphalt, ~9" gravel										
			Sandy Lean CLAY, medium stiff to stiff, moist, brown										
3					7								
6		CL			8								
9					10	22		26	11	2	46	52	
		GM	Silty GRAVEL with sand, very dense, moist, brown		50-5¾"								
12			Maximum depth explored approximately 11 feet due to refusal										
15													

Notes: No groundwater encountered.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 6

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG

NO.: B-5

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			TOPSOIL, sandy lean clay, moist, brown										
		CL	Sandy Lean CLAY, stiff, moist, brown		9								
6		GM	Silty GRAVEL with sand, very dense, moist, tan		90-11½"								
			Maximum depth explored approximately 6½ feet due to refusal										
9													
12													
15													

Notes: No groundwater encountered.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 7

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG
NO.: B-6

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ : 7.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			FILL, ~4" asphalt, 26" silty gravel										
3		CL	Lean CLAY, stiff, moist, brown		14								
6		SP-SM	Poorly Graded SAND with silt, medium dense (estimated), moist, light brown			5		16	NP	4	86	10	
9		GM	Silty GRAVEL with sand, very dense, wet, red-brown		56								
					50-5"								
12			Maximum depth explored approximately 10½ feet due to refusal										
15													

Notes: Groundwater encountered at approximately 7½ feet.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 8

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

BORING LOG

NO.: B-7

PROJECT: Duchesne High School
CLIENT: Duchesne County School District
LOCATION: See Figure 2
OPERATOR: Drill Tech
EQUIPMENT: Truck Mounted Drill Rig
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 199085
DATE: 01/15/20
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Est. Comp Stren (psf)
0			FILL, ~3" asphalt, 9" silty gravel										
3		SM	Silty SAND with gravel, medium dense, moist, light brown		15								
6		GM	Silty GRAVEL with sand, very dense, moist, brown			14	111	18	NP	24	41	35	C
					50-5¾"								
9			Maximum depth explored approximately 7½ feet due to refusal										
12													
15													

Notes: No groundwater encountered.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 9

LOG OF TESTHOLE LOGS.GPJ EARTHTEC.GDT 2/5/20

LEGEND

PROJECT: Duchesne High School **DATE:** 01/15/20
CLIENT: Duchesne County School District **LOGGED BY:** J. Balleck

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR SOIL DIVISIONS			USCS SYMBOL	TYPICAL SOIL DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% retaining on No. 200 Sieve)	GRAVELS (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVELS (Less than 5% fines)	GW	Well Graded Gravel, May Contain Sand, Very Little Fines
			GP	Poorly Graded Gravel, May Contain Sand, Very Little Fines
		GRAVELS WITH FINES (More than 12% fines)	GM	Silty Gravel, May Contain Sand
			GC	Clayey Gravel, May Contain Sand
	SANDS (50% or more of coarse fraction passes No. 4 Sieve)	CLEAN SANDS (Less than 5% fines)	SW	Well Graded Sand, May Contain Gravel, Very Little Fines
			SP	Poorly Graded Sand, May Contain Gravel, Very Little Fines
		SANDS WITH FINES (More than 12% fines)	SM	Silty Sand, May Contain Gravel
			SC	Clayey Sand, May Contain Gravel
FINE GRAINED SOILS (More than 50% passing No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		CL	Lean Clay, Inorganic, May Contain Gravel and/or Sand
			ML	Silt, Inorganic, May Contain Gravel and/or Sand
			OL	Organic Silt or Clay, May Contain Gravel and/or Sand
	SILTS AND CLAYS (Liquid Limit Greater than 50)		CH	Fat Clay, Inorganic, May Contain Gravel and/or Sand
			MH	Elastic Silt, Inorganic, May Contain Gravel and/or Sand
			OH	Organic Clay or Silt, May Contain Gravel and/or Sand
HIGHLY ORGANIC SOILS			PT	Peat, Primarily Organic Matter

SAMPLER DESCRIPTIONS



SPLIT SPOON SAMPLER
(1 3/8 inch inside diameter)

MODIFIED CALIFORNIA SAMPLER
(2 inch outside diameter)

SHELBY TUBE
(3 inch outside diameter)

BLOCK SAMPLE

BAG/BULK SAMPLE

WATER SYMBOLS

▽ Water level encountered during field exploration

▼ Water level encountered at completion of field exploration

NOTES:
1. The logs are subject to the limitations, conclusions, and recommendations in this report.
2. Results of tests conducted on samples recovered are reported on the logs and any applicable graphs.
3. Strata lines on the logs represent approximate boundaries only. Actual transitions may be gradual.
4. In general, USCS symbols shown on the logs are based on visual methods only: actual designations (based on laboratory tests) may vary.

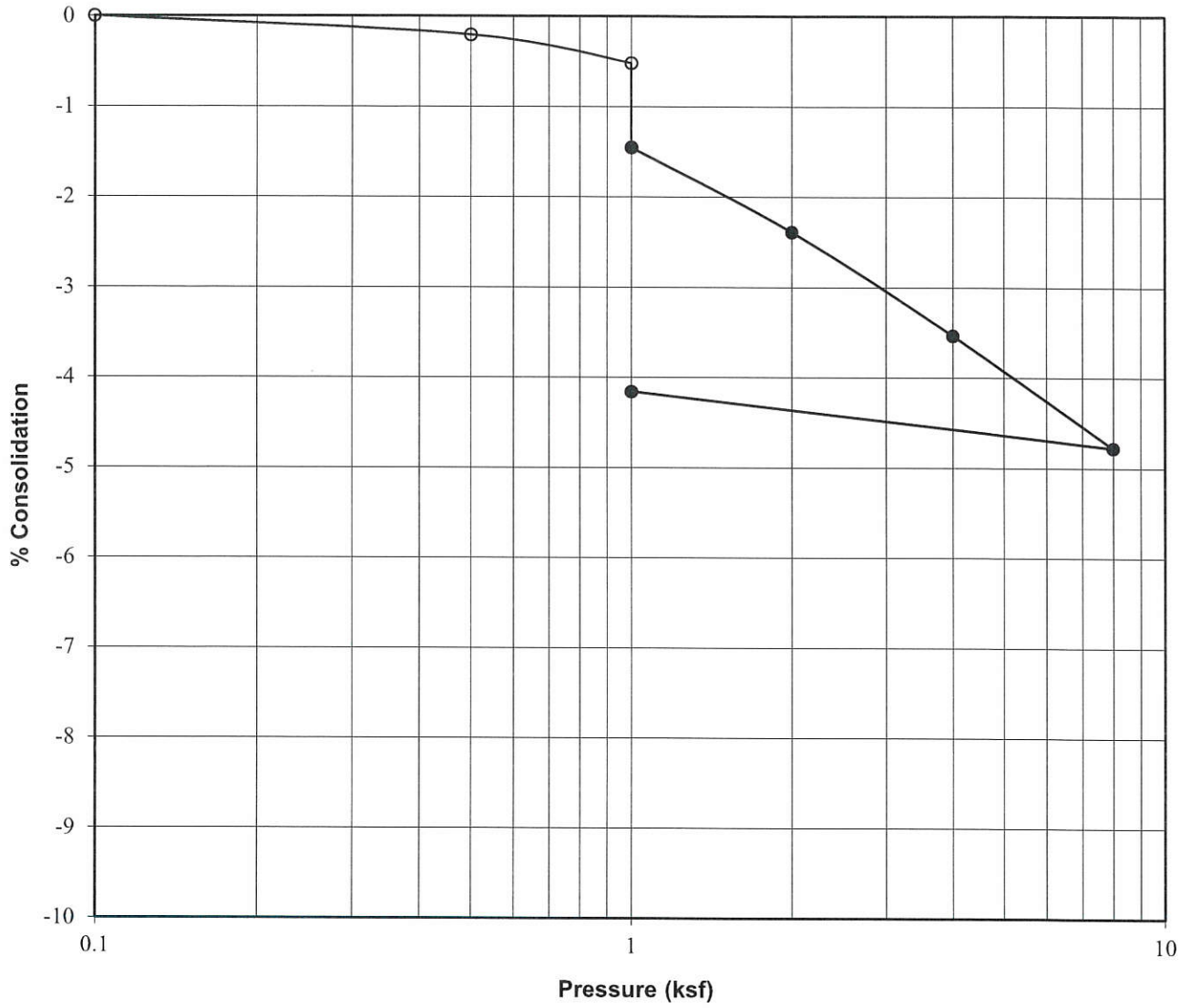
PROJECT NO.: 199085

EARTHTEC ENGINEERING

FIGURE NO.: 10

LEGEND LOGS.GPJ EARTHTEC.GDT 2/5/20

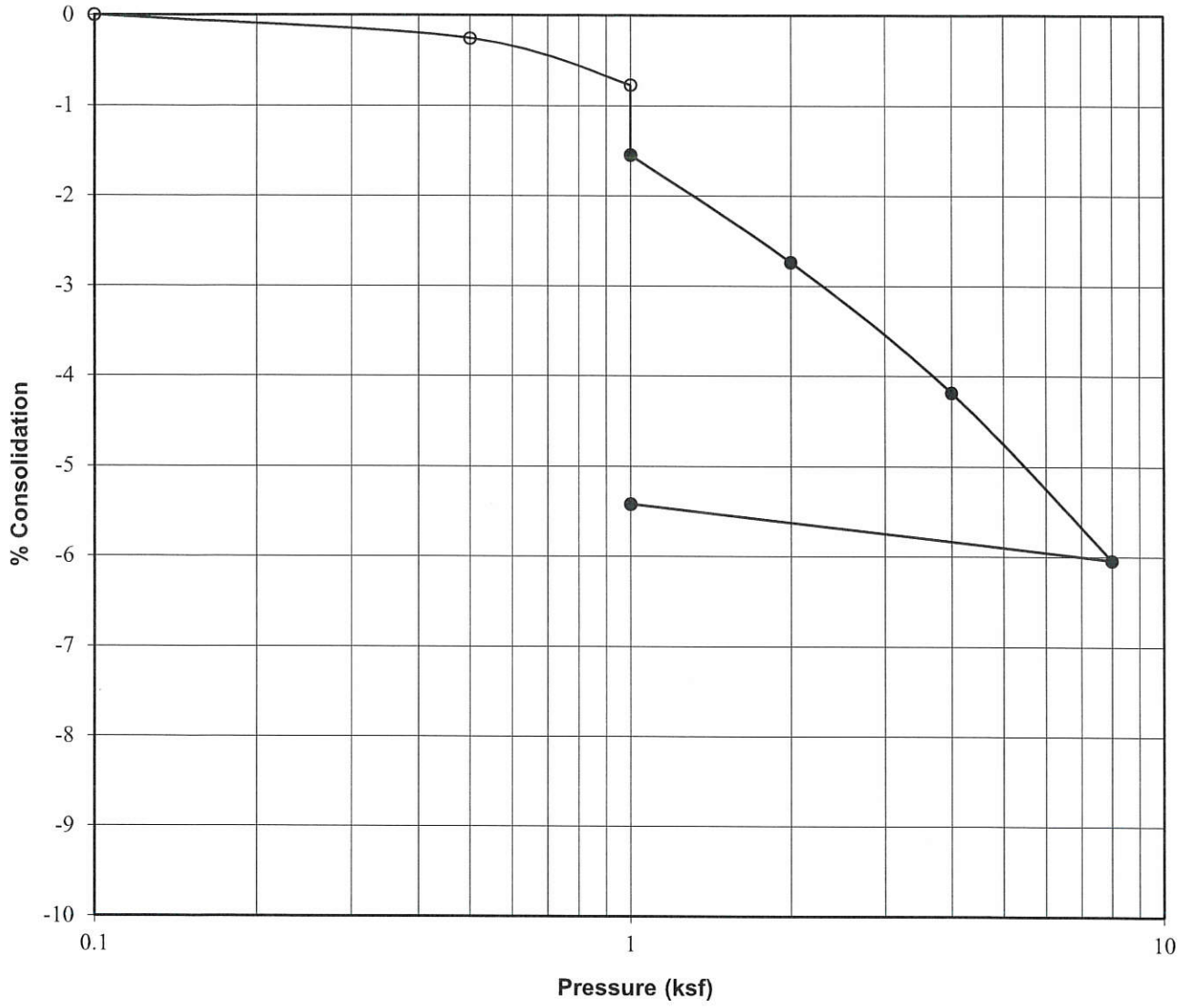
CONSOLIDATION - SWELL TEST



Project:	Duchesne High School
Location:	B-2
Sample Depth, ft:	2½
Description:	Shelby
Soil Type:	Silty SAND (SM)
Natural Moisture, %:	11
Dry Density, pcf:	107
Liquid Limit:	17
Plasticity Index:	2
Water Added at:	1 ksf
Percent Collapse:	0.9

PROJECT NO.: 199085	EARTHTEC ENGINEERING	**FIGURE NO.:** 11

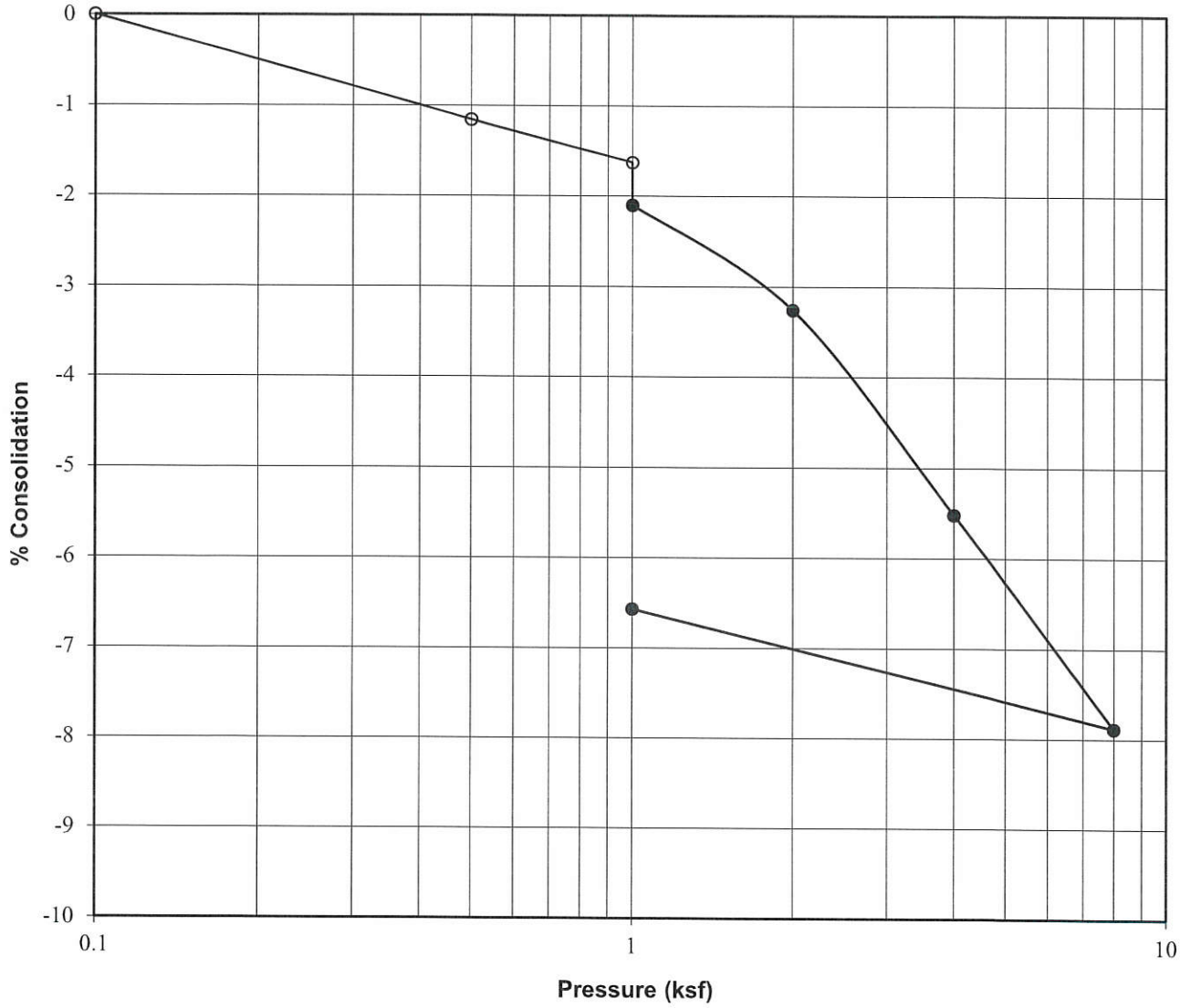
CONSOLIDATION - SWELL TEST



Project:	Duchesne High School
Location:	B-2
Sample Depth, ft:	7½
Description:	Shelby
Soil Type:	Lean CLAY (CL)
Natural Moisture, %:	30
Dry Density, pcf:	92
Liquid Limit:	32
Plasticity Index:	12
Water Added at:	1 ksf
Percent Collapse:	0.8

PROJECT NO.: 199085	EARTHTEC ENGINEERING	**FIGURE NO.:** 12

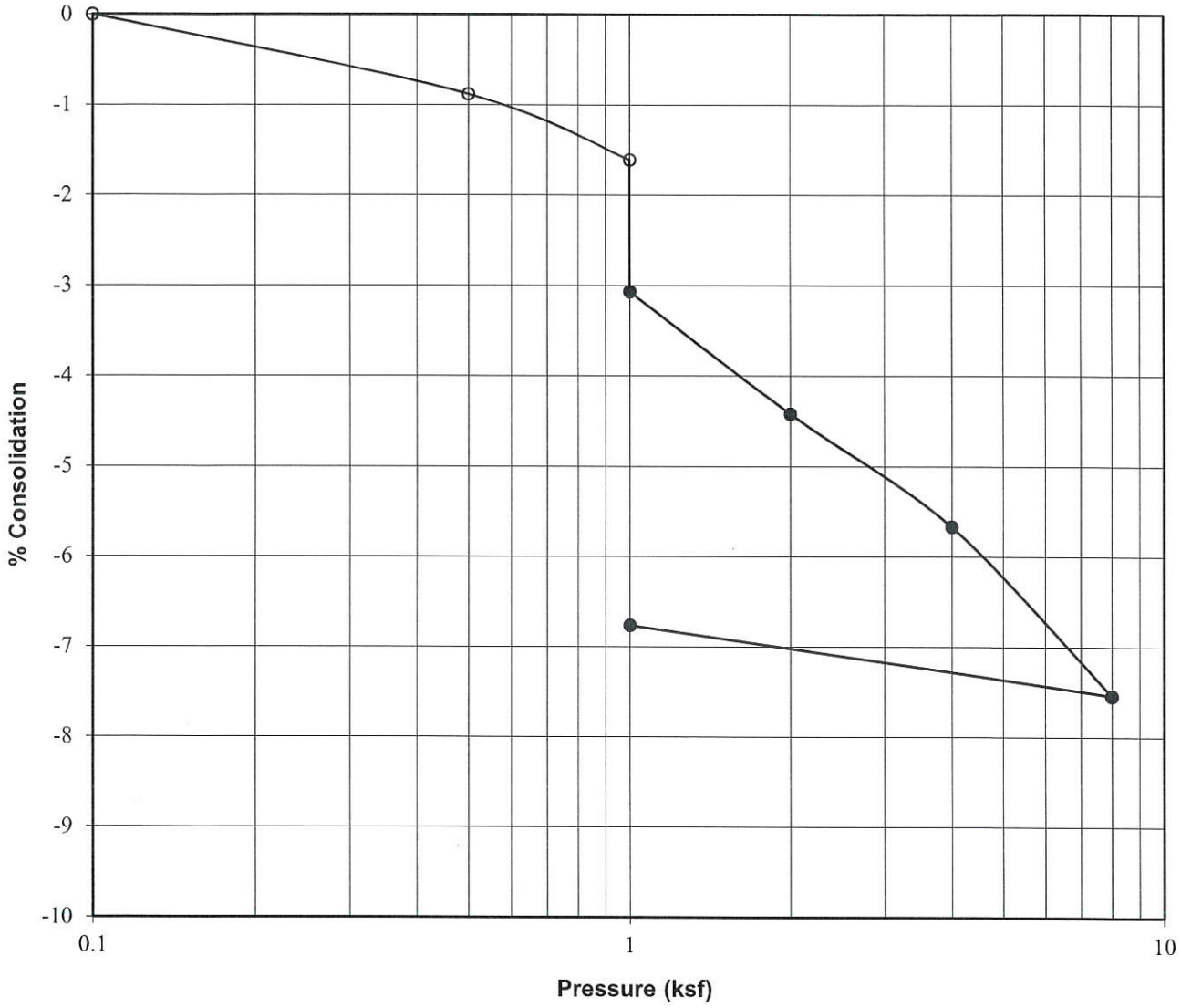
CONSOLIDATION - SWELL TEST



Project:	Duchesne High School
Location:	B-3
Sample Depth, ft:	5
Description:	Shelby
Soil Type:	Lean CLAY (CL)
Natural Moisture, %:	31
Dry Density, pcf:	89
Liquid Limit:	46
Plasticity Index:	21
Water Added at:	1 ksf
Percent Collapse:	0.5

PROJECT NO.: 199085	EARTHTEC ENGINEERING	**FIGURE NO.:** 13

CONSOLIDATION - SWELL TEST



Project:	Duchesne High School
Location:	B-7
Sample Depth, ft:	5
Description:	Shelby
Soil Type:	Silty SAND with gravel (SM)
Natural Moisture, %:	14
Dry Density, pcf:	111
Liquid Limit:	18
Plasticity Index:	NP
Water Added at:	1 ksf
Percent Collapse:	1.5

PROJECT NO.: 199085	EARTHTEC ENGINEERING	**FIGURE NO.:** 14

APPENDIX A

Timpview Analytical Laboratories

A Chemtech-Ford, Inc. Affiliate
1384 West 130 South Orem, UT 84058 (801) 229-2282

Certificate of Analysis

Earthtec Testing & Engineering
Jeremy Balleck
1497 W 40 S
Lindon, UT 84042
DW System # :

Work Order #: 20A0827
PO# / Project Name: 199085
Receipt: 1/16/20 13:00
Batch Temp °C: 14.4
Date Reported: 1/21/2020

Sample Name: **199085 B-5 @ 2.5**

Collected: 1/15/20 13:00 **Matrix:** Solid **Collected By:** Client

Parameter	Lab ID #	Method	Analysis Date / Time	Result	Units	MRL	Flags
Sulfate, Soluble (IC)	20A0827-01	EPA 300.0	1/17/20	85	mg/kg dry	12	
Total Solids	20A0827-01	SM 2540G	1/17/20	82.6	%	0.1	

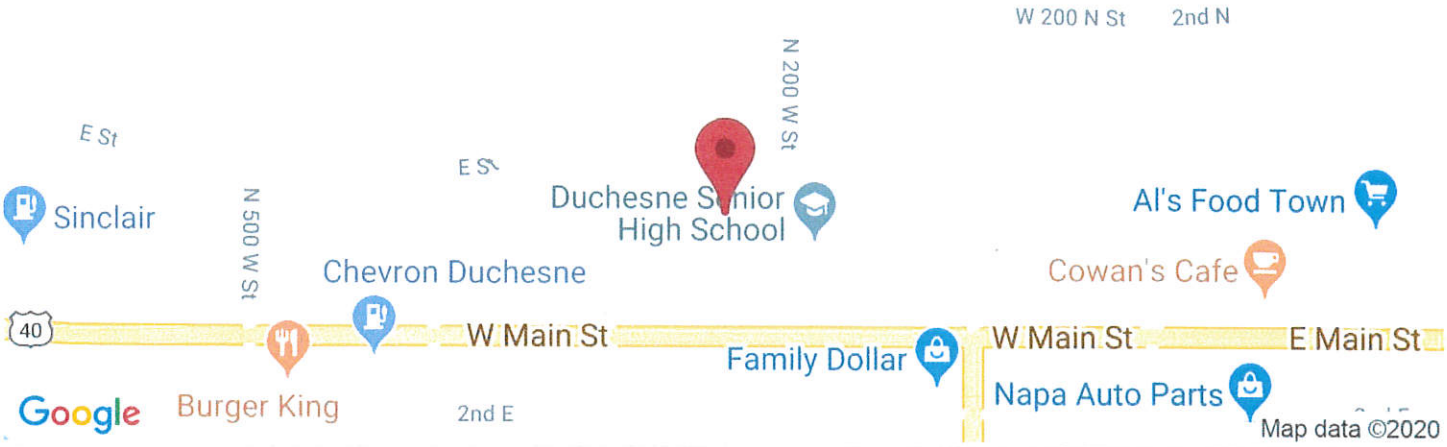
Comment:

Reviewed by: Joyce Applegate

Joyce Applegate, Project Manager

OSHPD

Latitude, Longitude: 40.164260, -110.405440



Date	2/5/2020, 9:33:44 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.316	MCE_R ground motion. (for 0.2 second period)
S_1	0.099	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.489	Site-modified spectral acceleration value
S_{M1}	0.238	Site-modified spectral acceleration value
S_{DS}	0.326	Numeric seismic design value at 0.2 second SA
S_{D1}	0.159	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	C	Seismic design category
F_a	1.547	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.171	MCE_G peak ground acceleration
F_{PGA}	1.459	Site amplification factor at PGA
PGA_M	0.249	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	0.316	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.334	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.099	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.105	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.946	Mapped value of the risk coefficient at short periods
C_{R1}	0.943	Mapped value of the risk coefficient at a period of 1 s

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of site built elements.

C. Selective demolition of building elements.

D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Sequencing and staging requirements.

C. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

D. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

E. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

G. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

H. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.

I. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-Demolition Conference: Conduct conference at Project site to comply with preinstallation conference requirements of Division 1 Section “Project Meetings.”

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Building Demolition: Demolish buildings completely and remove from the site. Use methods required to complete Work within limitations of governing regulations and as follows:
   1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   2. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
   3. Small buildings may be removed intact when permitted by Architect and approved by authorities having jurisdiction.
   4. Demolish concrete and masonry in small sections.
   5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   6. Break up and remove concrete slabs on grade, unless otherwise shown to remain.
   7. Remove air-conditioning equipment without releasing refrigerants.

B. Remove paving and curbs as required to accomplish new work.

C. Remove all other paving and curbs as indicated on drawings.

D. Remove below-grade construction, including foundations, footings, and all underground piping tunnels and rooms to the depths indicated.

E. Remove concrete slabs on grade as indicated on drawings.

F. Remove fences and gates.

G. Remove creosote-treated wood utility poles.

H. Remove other items indicated, for salvage, relocation, and recycling.

I. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

J. Excavated areas associated with the removal of all substructures should be backfilled with a well-graded granular material having a maximum size of 2 inches and not more than 15 percent passing a #200 sieve. All earth materials placed in excavated areas should be placed in maximum eight inch loose lifts and densified to an in place unit weight equal to 95% of the Maximum Laboratory Density as determined by ASTM D 1557 78.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 70 00.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from

removal operations.

10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

F. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

H. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury. Owner will remove hazardous materials under a separate contract.

I. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 01 74 19 - Waste Management.
   2. Dismantle existing construction and separate materials.
   3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

J. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

3.06 ASBESTOS

A. Asbestos Report, Inspection, Assessment, and Abatement by Owner.

B. If any asbestos is discovered by any contractor, the Owner and Architect are to be notified immediately.

END OF SECTION

DIVISION 3 – CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE
03 35 11	CONCRETE FLOOR FINISHES
03 45 00	PRECAST ARCHITECTURAL CONCRETE

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete for composite floor construction.

C. Floors and slabs on grade.

D. Concrete foundation walls and footings.

E. Concrete reinforcement.

F. Joint devices associated with concrete work.

G. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

H. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

B. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Concrete Construction 2020.

C. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

E. ACI 306R - Guide to Cold Weather Concreting 2016.

F. ACI 308R - Guide to External Curing of Concrete 2016.

G. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

M. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

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

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

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

Q. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

R. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

S. 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 2018a.

T. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Shop Drawings: For steel reinforcement. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, including special reinforcing required for openings through concrete structures.

E. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.

F. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Perform work of this section in accordance with ACI 301, "Specifications for Structural Concrete for Buildings" ACI 318, "Building Code Requirements for Reinforced Concrete."

B. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   3. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.
      a. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface. (If shown on plans)

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
   1. Type: Deformed billet-steel bars.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. Manufacture from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

a. For slab-on-grades, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type or Type II - Moderate.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M, graded, 3/4-inch nominal maximum coarse-aggregate size.
   1. Acquire aggregates for entire project from same source.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement, or causing spalling of concrete.

C. Fly Ash: ASTM C618, Class F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Chemical Admixture: Provide admixtures certified by manufacturer to be compatible with other admixtures.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Air Entrainment Admixture: ASTM C260/C260M.
   2. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
   3. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
   4. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
   5. Retarding Admixture: ASTM C494/C494M Type B.
   6. Water Reducing Admixture: ASTM C494/C494M Type A.
   7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
   1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
      a. 5.5 percent for 1-1/2 inch (38 mm) maximum aggregate.
      b. 6.0 percent for 1 inch (25 mm) maximum aggregate.
      c. 6.0 percent for 3/4 inch (19 mm) maximum aggregate.
   2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 3 percent air.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
   1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   2. Manufacturers:
      a. ISI Building Products; Viper VaporCheck II 10-mil (Class A): www.isibp.com/#sle.
      b. Poly-America; Husky Yellow Guard 10-mil Vapor Barrier: www.yellowguard.com/#sle.
      c. Stego Industries, LLC; Class A - 10 mils: www.stegoindustries.com/#sle.
      d. W. R. Meadows, Inc; PERMINATOR Class A - 10 mils (0.25 mm): www.wrmeadows.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.
   2. Manufacturers:
      a. Adhesives Technology Corporation; [_____]: www.atcepoxy.com/#sle.
      b. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: www.euclidchemical.com/#sle.
      c. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
      d. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
   1. Material: ASTM D1751, asphalt-saturated cellulose fiber.

2.07 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309, Type 1, Class B.
   1. Manufacturers: Subject to compliance with requirements, products that may be incorporated in the Work include the following:
      a. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com/#sle.
      c. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 CONCRETE MIXTURES

A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. 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, as accepted by Architect and structural engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

D. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: Per General Structural Notes.
   2. Water-Cement Ratio:
      a. Subjected to freezing and thawing: 45 percent.
      b. Subjected to deicers/watertight: 40 percent.
   3. Total Air Content: 6 percent, determined in accordance with ASTM C173/C173M.
   4. Maximum Slump: 3 inches (75 mm).
   5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

PART 3 EXECUTION

3.01 GENERAL

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

D. Chamfer exterior corners and edges of permanently exposed concrete.

E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

G. For all recessed floor areas and locations, see structural sheets.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Notify other trades to allow installation of their work.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 309.

C. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

D. Hot-Weather Placement: Comply with ACI 305 and as specified.
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg 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 water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high tempertures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

F. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

G. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
3. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab

surfaces.

4. Non-Slip Exterior Surfaces: Broom finish to be applied at exterior concrete platforms, steps, ramps, and elsewhere as indicated.
    a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

D. Concrete Polishing: See Section 03 35 11.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
    1. Normal concrete: Not less than seven days.

C. Surfaces Not in Contact with Forms:
    1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding or saturated burlap.
        a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
        b. Spraying: Spray water over floor slab areas and maintain wet.
        c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
    2. Final Curing: Begin after initial curing but before surface is dry.
        a. Moisture-Retaining Sheet: Lap strips not less than 3 inches (75 mm) and seal with waterproof tape or adhesive; secure at edges.
        b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer. Recoat areas subjected to heavy rainfall within three hours after intital application. Maintain continuity of coating and repair damage during curing period.
        c. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

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

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 03 30 00

SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Liquid densifiers and hardeners.

C. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 MOCK-UP

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied. Contractor to provide a mock-up area in an adjacent classroom for approval of final grinding level, color, and finish.

B. Mock-Up Size: 10 feet (3 m) square.

C. Locate in adjacent classroom that will receive carpet flooring to cover mock-up area.

D. Mock-up may not remain as part of the work.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the treatment of horizontal concrete to receive chemical product applications and mechanical dry polishing procedures. The applicator shall be approved by manufacturer.

B. Pre-Installation Meeting:
   1. Convene pre-installation meeting before start of installation of polished concrete floor system.
   2. Require attendance of parties directly affecting work of this Section, including Owner's representative, general contractor, SMS consultant executive and approved applicator.
   3. Review examination, surface preparation, installation, field quality control, protection and coordination and other work.
   4. Installer shall examine the existing conditions of the floor and bring up any concerns to the Architect in regards to floor finish and level of flatness.
   5. Ensure that the correct amount of densifier is onsite in manufacturer original unopened containers. Confirm with manufacturer representative that product is genuine, undiluted and meets all manufacturer quality control standards.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.08 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 40 degrees F (4 degrees C) within four hours of application.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using polished concrete finish.

B. Liquid Densifier/Hardener

C. Penetrating Clear Sealer:
   1. Use at following locations: Shops and Wrestling .

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
   1. Composition: Lithium silicate.
   2. Products:
      a. W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 COATINGS

A. Penetrating Sealer: Transparent, nonyellowing, water- or solvent-based coating.
   1. Products:
      a. Ameripolish, Inc; SR2 Concrete Sealer: www.ameripolish.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Natural Aggregate: Finely ground stone for addition to coatings for slip resistance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete units.
   1. Wall wainscot sill.
   2. Masonry wall caps.
   3. Locker bench seats.
   4. Balcony floor structure.
   5. Any other pre-cast concrete units shown on plans

B. Architectural precast concrete accessories.

C. Supports, anchors, and attachments.

D. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Admixtures.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).

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 2016a.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

F. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars 2019.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

H. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

J. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

K. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

L. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

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

N. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars 2021.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

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

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

R. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs. 2007.

S. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete 1988.

T. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction 2000.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials.
   1. Include details of mix designs.
   2. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

D. Samples: Submit two of each type of finish, 12 by 12 inch (300 by 300 mm) in size, illustrating surface finish, color and texture.

E. Material Test Reports: For aggregates, reinforcing, pre-stressing strands, admixtures, bearing pads, and water-absorption.

F. Material Certificates: Signed by manufacturers.

G. Maintenance Data: Indicate surface cleaning instructions.

1.05 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in Utah.

B. Fabricator Qualifications:
   1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
   2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

D. Mark units with date of production in location that will be concealed after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:
   1. Brailsford Pre-Cast Concrete Co, Springville, Utah.
   2. Hanson Structural Precast.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   2. Calculate structural properties of units in accordance with ACI 318.
   3. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   4. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
   1. Deformed billet-steel bars.
   2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
   3. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place according to PCI MNL 117.

2.04 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal or Type III, gray, unless otherwise indicated. Portland type.

B. Other Cementitious Materials:
   1. Fly Ash or Natural Pozzolans: Comply with ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.
   1. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
   2. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finished sample.
      a. Gradation: Uniformly graded or Gap graded.

D. Lightweight Structural Aggregate: ASTM C330/C330M.

E. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

G. Admixtures: Air entrainment and chemical admixtures as specified in Section 03 30 00.

H. Grout:
   1. Non-shrink, non-metallic, minimum 10,000 psi (70 MPa), 28 day strength.

2.05 SUPPORT DEVICES

A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
   1. Clean surfaces of rust, scale, grease, and foreign matter.

B. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

C. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

D. Carbon-Steel Plate: ASTM A 283/A 283M.

E. Malleable Iron Castings: ASTM A 47/A 47M.

F. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

G. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

H. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.

I. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

J. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.

K. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563/A563M nuts and matching washers.

L. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

M. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

2.06 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash to 15 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 days): 5000 psi (34.5 MPa) minimum.
   2. Maximum water-cement ratio at point of placement: 0.40

E. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

F. Lightweight Concrete Back-Up Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, using materials to be used on the Project, to provide lightweight concrete with the following properties:
   1. Compressive Strength (28-Day): 5000 psi (34.5 MPa) minimum.
   2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.07 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Fabricate and handle epoxy-coated reinforcing bars in accordance with ASTM D3963/D3963M.

C. Maintain plant records and quality control program during production of precast units. Make records available upon request.

D. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

E. Maintain consistent quality during manufacture.

F. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

H. Install window units in place while fabricating precast units. Protect assembly from damage.

I. Locate hoisting devices to permit removal after erection.

J. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

K. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.08 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135.

2.09 ACCESSORIES

A. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene(TFE); Shore A Durometer surface hardness 50 to 90; 1/8 inch (3 mm) thick, smooth both sides.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical.

E. Perform welding in accordance with AWS D1.1/D1.1M.

F. Touch-up field welds and scratched or damaged galvanized surfaces.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135.

3.05 FINISHES

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:
   1. Design Reference Sample: Coordinate with Architect and Fabricator.

B. Finish exposed top, bottom, and back surfaces of architectural precast concrete units to match face-surface finish.

3.06 REPAIRS

A. Repair damaged architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.07 CLEANING

A. Clean surfaces of precast concrete units exposed to view after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

DIVISION 4 – UNIT MASONRY ASSEMBLIES

04 01 00	MAINTENANCE OF MASONRY
04 20 00	UNIT MASONRY

SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water cleaning of unit masonry surfaces.

B. Repair of damaged masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Brick masonry units.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on cleaning compounds.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 MOCK-UP

A. Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Clean a 10 ft (3 m) by 10 ft (3 m) panel of wall for each type of masonry and surface condition to determine extent of cleaning.
   2. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
   3. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

B. Locate where directed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Check masonry unit manufacturer's recommendations for cleaning each type of masonry used on project.

B. Clean masonry every 7-14 days (maximum). Only use proprietary cleaner as specified by manufacturer of masonry.

C. Restoration and Cleaning Chemicals:
   1. PROSOCO: www.prosoco.com/#sle.
   2. EaCo Chem, Inc..
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CLEANING MATERIALS

A. Cleaning Agent: Detergent and Solvent cleaner type.

B. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean No. 101 Lime Solvent; Prosoco, Inc.

C. For dark-colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean No. 600 Detergent; Prosoco, Inc.

D. For light colored masonry (white, gray, tan, etc.)
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean Vana Trol; Prosoco, Inc.

E. For concrete masonry units.
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean Vana Trol; Prosoco, Inc.
   3. Sure Klean Custom Masonry Cleaner; Prosoco, Inc.
   4. Sure Klean 600 Detergent; Prosoco, Inc.

F. For honed block (interior).
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean Burnished Custom Masonry Cleaner; Prosoco, Inc.

G. For manufactured and natural stone veneer.
   1. EaCo Chem, Inc NMD 80 (new masonry detergent) or SOS 50 (new masonry detergent).
   2. Sure Klean Vana Trol Stone Cleaner; Prosoco, Inc.

H. DO NOT USE MURIATIC ACID AS A CLEANING METHOD.

2.03 MORTAR MATERIALS

A. Comply with requirements of Section 04 20 00.

2.04 MASONRY MATERIALS

A. Brick: Section 04 20 00.

B. Block: Section 04 20 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. Close off adjacent occupied areas with dust proof and weatherproof partitions.

3.03 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry as directed.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

F. Ensure that anchors are correctly located and built in.

G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.04 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch (6 mm) depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch (6 mm) layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

3.05 CLEANING EXISTING MASONRY

A. Cleaning Detergent: Spray clean masonry surfaces at all masonry locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

B. Chemical and High Pressure Steam Cleaning: 800 to 1200 psi (5500 to 8300 kPa) pressure, manufacturer's recommended chemical cleaning solution for brick and stone masonry surfaces at all locations to remove existing paint coating and leave surface with uniform, natural color and texture.

C. High Pressure Cold Water: Cold water blast with 800 to 1200 psi (5500 to 8300 kPa) pressure to brick masonry surfaces, at all locations, providing uniform finish.

3.06 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

D. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

3.07 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Foam fill insulation in exterior walls masonry units open cells.

F. Lintels.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

C. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A580/A580M - Standard Specification for Stainless Steel Wire 2018.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

H. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2021.

I. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2021.

J. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.

K. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2022a.

L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.

M. ASTM C150/C150M - Standard Specification for Portland Cement 2021.

N. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

O. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2021.

P. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.

Q. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

R. ASTM C476 - Standard Specification for Grout for Masonry 2020.

S. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale) 2021.

T. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2020.

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

V. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength 2019.

W. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar 1992a (Reapproved 2014).

X. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms 2021.

Y. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.

Z. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

AA. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry 2020.

BB. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

CC. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.

DD. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.

EE. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.

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

GG. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

D. Samples: Submit two samples of decorative block and facing brick units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

G. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.07 MOCK-UP

A. Construct a mock-up panel sized 4 feet (1.2 m) long by 4 feet (1.2 m) high; include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), wall insulation, and parging in mock-up.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

1.09 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Do not apply uniform floor or roof loads for at least 24 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm) and 6 inches (150 mm) and 4 inches.
   2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (13.8 MPa).
   3. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
      a. Provide bullnose units for outside corners.
   4. Load-Bearing Units: ASTM C90, normal weight.
      a. Pattern: Split-faced, smooth, colored, scored and honed CMU as shown on Drawings.
      b. Color: As selected by Architect to match existing.
      c. Manufacturers:
         1) Sunroc.
         2) AMCOR Block.
         3) Substitutions: See Section 01 60 00 - Product Requirements.
   5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.

2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.

b. Use only in combination with mortar that also has integral water repellent admixture.
c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type S.
1. Colored Mortar: Premixed cement as required to match Architect's color sample.
2. Manufacturers:
a. Lehigh Hanson.
b. Lafarge Holcim.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.
1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color. Match existing mortar color.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
1. Manufacturers:
a. Davis Colors, a division of Venator Materials PLC; True Tone Mortar Colors: www.daviscolors.com/#sle.
b. Solomon Colors, Inc; SGS Mortar Colors: www.solomoncolors.com/#sle.
c. Lafarge Holcim; Centurion Pigments.
d. Substitutions: See Section 01 60 00 - Product Requirements.

G. Water: Clean and potable.

H. Accelerating Admixture: Nonchloride type for use in cold weather, complying with ASTM C 494/C 494M, Type C.
1. Manufacturers:
a. Euclid Chemical Co..
b. W.R. Grace & Co..
c. Substitutions: See Section 01 60 00 - Product Requirements.

I. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
1. Use only in combination with masonry units manufactured with integral water repellent admixture.
2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
3. Meet or exceed performance specified for water repellent admixture used in masonry units.

J. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Type: Types as scheduled in this section.
2. Color: Mineral pigments added as required to produce approved color sample.
3. Manufacturers:

a. Glen-Gery Corporation; Color Mortar Blend.
b. Lafarge Holcim; Centurion Colorbond PL.
c. Lehigh Hanson; Lehigh Custom Color Portland/Lime.

2.03 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
1. Hohmann & Barnard, Inc: www.h-b.com/#sle.
2. WIRE-BONDwww.wirebond.com/#sle.
3. Heckman Building Products, Inc..
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; uncoated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss.
2. Material: stainless steel conforming to ASTM A580/A580M Type 304 for exterior walls, and ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3 for interior walls.
3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

E. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.
1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch (25 mm) width x 0.024 in (0.61 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch (3.8 mm) diameter.

2.04 FLASHINGS

A. Metal Flashing Materials:
1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch (0.48 mm) thick; finish 2B to 2D.

B. Combination Asphaltic Flashing Materials - Copper:
1. Copper/Asphalt Flashing: 5 oz/sq ft (1.52 kg/sq m) copper sheet bonded between 2 layers asphalt saturated glass fabric.

a. Manufacturers:
1) Advanced Building Products, Inc; Copper Fabric Flashing: www.advancedbuildingproducts.com/#sle.
2) Hohmann & Barnard, Inc; H & B C-Fab Flashing: www.h-b.com/#sle.
3) York Manufacturing, Inc.; York Copper Fabric Flashing.
4) Substitutions: See Section 01 60 00 - Product Requirements.

C. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

D. Termination Bars: Stainless steel; compatible with membrane and adhesives.

E. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

G. Metal Expansion-Joint Strips: Fabricate from copper to shapes indicated.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

D. Nailing Strips: Softwood lumber, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

E. Weeps:
1. Type: Polyester mesh, rectangular plastic weep/vent tubing, or cellular plastic weep/vent.
2. Color(s): As selected by Architect from manufacturer's full range.
3. Manufacturers:
a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
c. Mortar Net Solutions: www.mortarnet.com/#sle.
d. WIRE-BOND: www.wirebond.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Cavity Vents:
1. Type: Polyester mesh.
2. Color(s): As selected by Architect from manufacturer's full range.
3. Manufacturers:
a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
b. CavClear, a Division of Archovations Inc: www.cavclear.com/#sle.
c. Hohmann & Barnard, Inc: www.h-b.com/#sle.
d. Mortar Net Solutions: www.mortarnet.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

G. Drainage Fabric: Polyester or polypropylene mesh bonded to a water and vapor-permeable fabric.
1. Manufacturers:
a. Advanced Building Products, Inc.: www.advancedbuildingproducts.com/#sle.
b. Mortar Net Solutions: www.mortarnet.com/#sle.
c. CavClear; www.cavclear.com
d. Hohmann & Barnard; www.h-b.com
e. Substitutions: See Section 01 60 00 - Product Requirements.

H. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.06 MASONRY- CELL INSULATION (EXTERIOR MASONRY WALLS)

A. Foamed-In-Place Masonry Wall Insulation: "Core-Fill 500" Foam Insulation as manufactured by Tailored Chemical Products; www.core-fill500.com or approved substitution.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral high-density skin.

2.07 LINTELS

A. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

2.08 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. For reinforced masonry: Type S.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. New Mortar for Old Brick: Proportioned by volume only; not more than 20 percent of the total volume of Portland cement and lime combined shall be Portland cement.

D. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
   1. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

E. Do not use admixtures, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.

C. Cold Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
   1. 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).

2. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry.
3. 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Use heat on both sides of walls under construction.
4. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.

D. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
1. 40 to 25 deg F (4 to -4 deg C): Cover masonry with a weather-resistant membrane for 48 hours after construction.
2. 25 to 20 deg F (-4 to -7 deg C): Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h (25 km/h).
3. 20 deg F (-7 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after construction.

E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg c) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

F. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: As indicated for different locations.
2. Mortar Joints: Concave.

D. Brick Units:
1. Bond: As indicated for different locations.
2. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
   1. Verify that airspace width is no more than 3/8 inch (9 mm) greater than panel thickness.
   2. Hold cavity mortar control panel tight to face wythe.
   3. Install horizontally between joint reinforcement.
   4. Stagger end joints in adjacent rows.
   5. Fit to perimeter construction and penetrations without voids.

D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches (150 mm).

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

G. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches (38 mm) with at least 5/8 inch (16 mm) mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 36 inches (900 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

B. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.10 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 2 inches (50 mm), minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches (203 mm) minimum on vertical surface of backing:

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

E. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.12 CAVITY- WALL AND MASONRY- CELL INSULATION

A. On units of plastic board insulation, place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c., both ways on inside face or attach to inside face 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.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

B. Fill all open cells and voids in hollow concrete masonry walls where shown on Drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

C. Grout all masonry cells in walls around restrooms, mechanical, and boiler rooms.

3.13 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

C. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

3.14 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.15 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

D. Form expansion joint as detailed on drawings.

3.16 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, fabricated metal frames, window frames, wood nailing strips, foundation vents, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

3.17 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

E. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.18 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.19 PARGING

A. Dampen masonry walls prior to parging.

B. Scarify each parging coat to ensure full bond to subsequent coat.

C. Parge masonry walls in two uniform coats of mortar to a total thickness of 3/4 inch (19 mm).

D. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot (1 mm/m).

E. Strike top edge of parging at 45 degrees.

3.20 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

E. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

3.21 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

END OF SECTION

DIVISION 5 – 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 52 13	PIPE AND TUBE RAILINGS
05 70 00	DECORATIVE METAL RAILINGS
05 71 00	DECORATIVE METAL STAIRS

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

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 2020.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.

G. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.

H. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2020.

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 2018a.

J. 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 2021.

K. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

Q. SSPC-SP 3 - Power Tool Cleaning 2018.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections.
   3. Indicate cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

D. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Utah.

C. Preinstallation Conference: Conduct conference at Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.

1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Plates, Channels, and Bars: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M Grade 50.

C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

D. Pipe: ASTM A53/A53M, Type E or S, Grade B, Finish black and galvanized, as indicated.

E. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

F. Headed Anchor Rods: ASTM F1554 Grade 36, zinc-coated.

G. Threaded Rods: ASTM A 36/A 36M, zinc-coated.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Prepare steel surfaces as recommended by manufacturer of shear connectors.

C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

D. Fabricate connections for bolt, nut, and washer connectors.

E. Develop required camber for members.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, high strength bolted, or galvanized surfaces.

2.04 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts."

C. Welded Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Structural Engineer.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements. Agency may inspect structural steel at plant before shipment.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts."

C. Welded Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 05 12 00

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

1.02 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

B. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.

C. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.

D. 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 2021.

E. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2014, with Amendment (2015).

G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

H. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

I. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders 2020.

J. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders 2008.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

L. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Utah.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom and top chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
   3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.

B. Open Web Joists: SJI 100 Type LH Joists:
   1. Provide bottom and top chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.

C. Anchor Bolts, Nuts and Washers: ASTM A307 plain.

D. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FINISH

A. Shop prime joists as specified.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Position and field weld joist chord extensions and wall attachments as detailed.

F. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).

G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

H. Do not field cut or alter structural members without approval of joist manufacturer.

I. After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.

END OF SECTION

SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical roof deck.

B. Roof deck.

C. Composite floor deck.

D. Stud shear connectors.

E. Acoustical insulation in roof deck flutes.

1.02 REFERENCE STANDARDS

A. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.

E. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems 2016.

F. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks 2007.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Submit manufacturer's installation instructions.

F. Field quality-control test and inspection reports.

G. Research/Evaluation Reports: For steel deck, compliance with IBC in effect for the project.

1.04 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Utah.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: www.canam-steeljoists.ws.
   2. ASC Profiles, Inc.

3. Butler Manufacturing Co.
4. Epic Metals Corporation
5. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
6. Roof Deck, Inc.
7. Steelco Co., Inc.
8. Verco Manufacturing Co.
9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
   1. Calculate to structural working stress design and structural properties specified.

B. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch (3 mm) diameter holes staggered 3/8 inch (10 mm) on center:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 40/275, with G60/Z180 galvanized coating.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Profile: Fluted; SDI NR.
   4. Both 1 1/2 inch and 3 inch are depths are required. See framing plans.
   5. Side Joints: Lapped, welded.
   6. End Joints: Lapped, welded.
   7. Minimum NRC Value: 0.95

C. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 50, with G60/Z180 galvanized coating.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Minimum Base Metal Thickness: Refer to general structural notes.
   4. Nominal Height: Refer to general structural notes.
   5. Profile: Fluted; SDI NR.
   6. Side Joints: Refer to general structural notes.
   7. End Joints: Refer to general structural notes.

D. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G60/Z180 galvanized coating.
   2. Minimum Base Metal Thickness: 20 gage, 0.0359 inch (0.91 mm).
   3. Nominal Height: 2 inches (51 mm).
   4. Side Joints: Lock seam.
   5. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

A. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.

B. Welding Materials: AWS D1.1/D1.1M.

C. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
   1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.

D. Weld Washers: Mild steel, uncoated, 3/4 inch (19 mm) outside diameter, 1/8 inch (3 mm) thick.

E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

F. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.

G. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gage, 0.0359 inch (0.91 mm) thick sheet steel; of profile and sizeas indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gage, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.

C. On steel supports provide minimum 2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
   1. Welding: Use fusion welds through weld washers.

E. Clinch lock seam side laps.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. At welded male/female side laps weld at 12 inches (300 mm) on center maximum.

H. Weld deck in accordance with AWS D1.3/D1.3M.

I. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

J. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

K. Weld stud shear connectors through steel deck to structural members below.

L. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Formed steel joist framing and bridging.

C. Water-resistive barrier over sheathing.

1.02 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2018).

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage: 20 gage, 3 5/8 inch.
   2. Flange Width: 1 5/8 inch (41 mm).
   3. EQ studs are accepted up to 13 ft.

B. Steel Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating. Manufacturer's standard C-shaped steel joists of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Gage and Depth: As required to meet structural requirements.

C. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch (3.42 mm), and factory punched holes and slots.

2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.03 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 12 inches (300 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

F. Install load-bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

J. Attach cross studs to studs for attachment of fixtures anchored to walls.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at spacing indicated; not more than 2 inches (50 mm) from abutting walls, and connect joists to supports using fastener method.

D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load-bearing studs or provide load distributing member to top of stud track.

F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

B. Prefabricated ladders and ship ladders.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.

B. Section 05 21 00 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

C. Section 05 51 00 - Metal Stairs.

D. Section 05 52 13 - Pipe and Tube Railings.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).

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

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2021).

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

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 2018a.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

N. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Design metal fabrications under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Utah.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black and hot-dip galvanized finish, as indicated.

E. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
   2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; galvanized finish.

D. Lintels: As detailed; galvanized finish.

E. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

F. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

2.04 PREFABRICATED LADDERS

A. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Carbon steel; ASTM A1011/A1011M Grade 36, minimum.

2.05 FINISHES - STEEL

A. Prime paint steel items.

1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for galvanized finish.
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

END OF SECTION

SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with grating treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 05 52 13 - Pipe and Tube Railings: Metal handrails for the stairs specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2021.

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

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

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 2021a.

H. 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 2021.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

K. NAAMM AMP 510 - Metal Stairs Manual 1992.

L. NAAMM MBG 531 - Metal Bar Grating Manual 2017.

M. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual 2019.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide For metal stairs.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Utah, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
   2. Industrial: All joints made neatly.
      a. Welded Joints: Welded on back side wherever possible.
      b. Welds Exposed to Touch: Ground smooth.
      c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Closed.

C. Treads: Steel bar grating.
   1. Grating Type: Welded.
   2. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
   3. Top Surface: Standard.
   4. Nosing: Checkered plate.
   5. Nosing Width: 1-1/4 inch (32 mm), minimum.
   6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Cold Formed HSS.
   1. Stringer Depth: As indicated on drawings.
   2. End Closure: Sheet steel, 14 gauge, 0.075 inch (1.9 mm) minimum; welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: See Section 05 52 13.

B. Guards: Pipe railings, see Section 05 52 13.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Ungalvanized Steel Sheet: Cold-rolled only.
   1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC - SP 3, "Power Tool Cleaning".
   2. Number of Coats: One.

D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

D. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 05 51 00 - Metal Stairs: Attachment plates for handrails specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

C. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

D. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Utah, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot (730 N/m) applied to the top of the assembly and in any direction, without damage or permanent set in accordance with Section 1607.8 of the 2018 IBC. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set in accordance Section 1607.8 of the 2018 IBC. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 40, galvanized finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Stainless Steel Top Rail: Top rail of metal handrails and guardrails to be stainless steel welded to guardrail vertical posts. See drawings for details.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by continuous welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 70 00
DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing and guardrail assemblies.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 - Construction Waste Management and Disposal: Additional requirements for cleaning.

B. Section 05 71 00 - Decorative Metal Stairs.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

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 C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

I. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements 2022.

J. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

L. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

D. Samples: Submit one (1) of each item below for each type and condition shown.
   1. Glass: 12 inch by 12 inch (305 mm by 305 mm), illustrating color, thickness and edge condition.
   2. Railing: 12 inch (305 mm) long section of handrail illustrating color, finish and connection detail.
   3. Cladding: 6 inch by 6 inch (152 mm by 152 mm) sample of each type of cladding, illustrating finish.

E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover in a dry location.

1.07 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C).

B. Maintain ambient temperature of space at minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C) for 24 hours before, during, and after railing installation.

1.08 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Railings:
   1. Metal Line Manufacturing.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Railing Components:
   1. Metal Line Manufacturing.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

C. Metal Rail Infill:
   1. Metal Line Manufacturing.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
      a. Lateral Force: 75 lb (333 N) minimum, at any point, when tested in accordance with ASTM E935.
      b. Distributed Load: 50 lb/ft (0.73 kN per m) minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
      c. Concentrated Loads on Intermediate Rails: 50 psf (0.22 kgs per sq m), minimum.
      d. Concentrated Load: 200 lbs (888 N) minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
      e. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
   3. Joints: Tightly fitted and secured, machined smooth with hairline seams.

4. Field Connections: Provide sleeves to accommodate site assembly and installation.
5. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
    a. Ease exposed edges to a small uniform radius.
    b. Welded Joints:
        1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
        2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

B. Glazed Post Railing System: Engineered, post-supported railing system with glass infill panels. (All second-story balcony and stair areas)
1. Configuration: Guardrail only with seperate handrail at stairs. As indicated on drawings.
2. Top Rail: Rectangular, stainless steel.
3. Grip Rail: Round, stainless steel, 1-1/2 inch (38 mm) diameter.
4. Posts: Rectangular or square, steel, to be painted.
5. Glass: As specified in this section.
6. Glass Mounts: Pressure clamps/infill mounts, same metal as railing; no holes drilled in glass.
7. Stainless Steel Finish, Exposed Surfaces: No. 4 satin finish.

2.03 MATERIALS

A. Stainless Steel Components:
1. ASTM A666, Type 304.

B. Glass: Laminated safety glass; ASTM C1172, unless otherwise indicated.
1. Plastic Interlayer: Minimum 0.060 inch (1.52 mm) thick.
2. Impact Strength: Category II, tested in accordance with 16 CFR 1201.
3. Thickness: 1/2 inch (13 mm).
4. Configuration: As indicated on drawings.
5. Edges: Ground smooth and polished.
6. Color: Clear, no tint.

2.04 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
3. For anchorage to stud walls, provide backing plates for bolt anchors.
4. Exposed Fasteners: No exposed bolts or screws.

C. Carbon Steel Bolts and Nuts: ASTM A307.

D. Sealant: Silicone; clear.

E. Finish Touch-Up Materials: As recommended by manufacturer for field application.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

A. Protect existing work.

B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 FIELD QUALITY CONTROL

A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

C. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.

D. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 05 71 00
DECORATIVE METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal stairs.

1.02 RELATED REQUIREMENTS

A. Section 05 70 00 - Decorative Metal Railings: Railing and guardrail assemblies.

1.03 REFERENCE STANDARDS

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

B. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.

C. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

E. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of railings and guards with work specified in this section.

B. Preinstallation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
   1. Contractor.
   2. Architect.
   3. Owner's representative.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.

C. Shop Drawings: Indicate stair plans, elevations, and sections, details of profiles, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Maintenance Data: Manufacturer's instructions for care and cleaning.

1.06 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Utah or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M no more than 12 months before start of scheduled welding work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials for damage upon delivery. Replace damaged materials that cannot be repaired to be indistinguishable from undamaged parts and finishes.

D. Prior to installation, store materials and components under cover in a dry location.

PART 2 PRODUCTS

2.01 DECORATIVE METAL STAIRS

A. Decorative Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings and guards, fabricated for anchorage to each other and to building structure.
   1. Regulatory Requirements: Comply with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Comply with the following:
      a. Stair Capacity:
         1) Live Load: Uniform live load of 100 lb/sq ft (4.7 kPa) and a maximum concentrated load of 300 lb (136 kg).
         2) Dead Load: Weight of stair, associated railing system, concrete fill, cladding and other finishes.
         3) Deflection Limits: Deflection of stringer or landing framing not to exceed 1/360 of span.
   3. Configuration and Dimensions: As indicated on drawings.

B. Metal Jointing and Finish Quality Levels: Architectural, as defined below.
   1. Architectural: Inconspicuous joints, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

2.02 COMPONENTS

A. Treads: Concrete-filled steel pan treads.
   1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
   4. Concrete Finish: For resilient floor covering.

B. Risers: Closed.

C. Risers: Solid steel sheet.
   1. Nosing Depth: Not more than 1 inch overhang.

D. Stringers: Steel tubes.
   1. Stringer Depth: As indicated on drawings.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railing Systems: See Section 05 70 00.

2.03 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.

2.04 ACCESSORIES

A. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as stair components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
   3. For anchorage to stud walls, provide backing plates for bolt anchors.

4. Exposed Fasteners: No exposed bolts or screws.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Finish Touch-Up Materials: As recommended by manufacturer for field application.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

A. Protect existing work.

B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

DIVISION 6 – WOODS AND PLASTICS

06 10 00	ROUGH CARPENTRY
06 20 00	FINISH CARPENTRY
06 41 00	ARCHITECTURAL WOOD CASEWORK
06 46 33	SOLID SURFACING WINDOW SILLS

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Roofing nailers.

C. Roofing cant strips.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Miscellaneous framing and sheathing.

G. Communications and electrical room mounting boards.

H. Concealed wood blocking, nailers, and supports.

I. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

E. AWPA U1 - Use Category System: User Specification for Treated Wood 2021.

F. PS 1 - Structural Plywood 2009 (Revised 2019).

G. PS 20 - American Softwood Lumber Standard 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on application instructions and fire retardant treatment information.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":
   1. Dimension lumber framing.
   2. Laminated veneer lumber.
   3. Prefabricated wood I-joists.
   4. Rim boards.
   5. Miscellaneous lumber.

B. Single-Source Responsibility for Fire Retardant Treated Wood: Obtain each type of fire-retardant-treated wood products from one source for both treatment and fire-retardant formulation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: Kiln-dry or MC15.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).
   1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly.
   2. Manufacturers:
      a. CertainTeed Corporation; GlasRoc Brand: www.certainteed.com/#sle.
      b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Do not use treated wood in direct contact with the ground.

2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   b. Treat lumber in contact with roofing, flashing, or waterproofing.
   c. Treat lumber in contact with masonry or concrete.
   d. Treat lumber less than 18 inches (450 mm) above grade.
   e. Treat lumber in other locations as indicated.
2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   b. Treat plywood in contact with roofing, flashing, or waterproofing.
   c. Treat plywood in contact with masonry or concrete.
   d. Treat plywood less than 18 inches (450 mm) above grade.
   e. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Provide the following specific nonstructural framing and blocking:
1. Chalkboards and marker boards.
2. TV display monitors.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of top wall plates at roof parapets with wall and roofing assembly installation.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: As indicated on drawings.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

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. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

E. PS 1 - Structural Plywood 2009 (Revised 2019).

F. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.

C. Samples: Submit two samples of finish plywood illustrating wood grain and specified finish.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Riff-sawn, clear, kiln-dried oak selected for compatible grain and color.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 SHEET MATERIALS

A. Softwood Plywood: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.04 FASTENINGS

A. Fasteners: Of size and type to suit application indicated to provide secure attachment, conceal where possible.
   1. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.
   2. Caulk all joints and edges where necessary for smooth transition at trim.

2.05 ACCESSORIES

A. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 WOOD TREATMENT

A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

B. Water Repellent Preservative Treatment by Dipping Method: WDMA I.S. 4, with 0.25 percent retainage.

C. Provide identification on fire retardant treated material.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Textured panels.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 08 80 00 - Glazing: Glass for casework.

C. Section 06 46 33 - Solid-surfacing-material window sills.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. BHMA A156.9 - Cabinet Hardware 2020.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: Show location of each item, dimensioned plans, and elevations, large scale details, attachment devices, and other components.

C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

B. Quality Certification:
   1. Provide designated labels on shop drawings as required by certification program.
   2. Provide designated labels on installed products as required by certification program.
   3. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   4. Replace, repair, or rework all work for which certification is refused.

1.06 MOCK-UP

A. If manufacturer is **not** on the approved manufacturer's list below (2.01), provide mock-up of typical base cabinet and countertop, including hardware and finishes for approval of Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Granite Mill.

B. Johnson Brothers Mill.

C. Huetter Mill.

D. Artistic Mill.

E. Clients Design.

F. Mapleleaf Cabinets.

G. Substitutions: See Section 01 60 00 - Product Requirements.

H. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Semi-Exposed Surfaces: Decorative laminate.
   4. Finish - Concealed Surfaces: Manufacturer's option.
   5. Door and Drawer Front Edge Profiles: Square edge with thick applied band, exterior edges are to be heavy duty 3 mm PVC edge banding. Color to be selected by Architect.
   6. Casework Construction Type: Type A - Frameless.
   7. Wood Products: Comply with the following:
      a. Hardboard: AHA A 135.4.
      b. Medium-Density Fiberboard; ANSI A208.2, Grade **MD - Exterior Glue.**
      c. Softwood Plywood: DOC PS 1, **Medium Density Overlay**
   8. Cores: Sides, tops, bottoms, shelves, doors, drawer fronts, Plywood cores only with surface of thermally fused, polyester decorative surfacing - Velvet finish where semi-exposed, plastic laminate where exposed. **Particle board cores are not acceptable.**
      a. Multi-Core Panel Products
         1) States Industries "Armorcore"
         2) True North "Multi-Core"
   9. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
   10. Grained Face Layout for Cabinet and Door Fronts: Style and Rail, all Grades.
      a. Drawer fronts run grain either vertically or horizontally at the manufacturer's option.
      b. Doors: Vertical grain.
   11. Cabinet Design Series: As indicated on drawings.
   12. Cabinet Style: Reveal overlay.
   13. Textured Panels: MDF textured panel at various locations (See Drawings). Soelberg Industries.
      a. Full range of finish options as selected by Architect.
      b. Install per manufacturer's recommendation.

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.04 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com/#sle.
   2. Panolam Industries International, Inc; Nevamar; Pionite: www.nevamar.com/#sle.
   3. Wilsonart LLC: www.wilsonart.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. Color selected by Architect

D. Provide specific types as indicated.
1. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, (CL 20), through color, color as selected, finish as selected.

2.05 COUNTERTOPS

A. Solid Laminated Wood Surfacing: Provide Custom quality hardwood; maple, plain sawn, exposed edge grain; laminated with waterproof adhesives; thickness as recommended by fabricator; suitable for transparent finish. (Shops)

B. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated and self-edge banded. (Typical classroom and all other countertops)

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.

2.07 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

D. Fixed Specialty Workstation and Countertop Brackets:
1. Material: Steel.
2. Color: Black.

E. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers ("U" shaped wire pull, aluminum with satin finish, 100 mm centers).

F. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
1. Product: M20071L manufactured by National Lock.
2. Or approved equal.
3. Install in cabinets where indicated on drawings. All locks shall be installed in a hole shaped the same shape as the cylinder of the lock to eliminate rotation. Round lock cylinders installed in round holes will not be allowed. Each room to have its own cabinet keying (all cabinets in each room to be keyed alike). Millwork contractor to provide key schedule with all cabinet locks identified.

G. Catches: Magnetic, not to exceed 7 pound pull.

H. Drawer Slides:
1. Type: KV1284 or equal, roller bearing, Full extension.
2. Static Load Capacity: Heavy Duty grade, 100 lbs rated.
3. Mounting: Bottom mounted.
4. Stops: Positive type.
5. Features: Provide self closing/stay closed type.

I. File Drawer Slides: (All file drawers and drawers over 30 inches in width)
1. Type: Hettich/Grant 5632 or equal, roller bearing, Full extension.
2. Static Load Capacity: Heavy Duty grade, 100 lbs rated.

3. Mounting: Bottom mounted.
4. Stops: Positive type.
5. Features: Provide self closing/stay closed type.

J. Hinges
1. Commercial Hinge: Dull chrome or black color 2-3/4" fixed pin, five knuckle, 270 degree swing, hospital type. RPC #B854, no known equal. Provide three hinges on all doors over 48" high and four hinges on all doors over 84" high.
2. European style concealed self-closing type (use in administration and media cabinets).

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Doors: Minimum 0.745" thick. Provide magnetic catch when hinges are not provided with a built-in closer. Provide two catches on doors over 48" high.

E. Drawers: Fabricate drawer fronts same as doors. Side shall be 1/2" and subfronts and back shall be 3/4" thick. Drawers shall be dowel construction, assembled true and square within a clamp and shall be provided with 8mm hardwood fluted dowels at a minimum of 1-1/4" o.c. at each joint. Provide all drawers with 1/4" hardboard bottoms housed into sides, subfront and back and glue entire perimeter with hotmelt adhesive. Provide 1/2" thick drawer bottoms for drawers over 30" wide. Also provide a 1/2" x 2 -1/2" reinforcing strip on underside of bottom, at center, on all drawers exceeding 30" wide. Drawers shall be mounted with positive "IN" and "OUT" stops to provide permanent alignment and quiet operation. Drawer fronts that impact cabinet body will not be allowed.

F. File Drawers: Fabricate same as drawers, only equip with full extension drawer slides, and provide support rails to support Owner provided pendaflex file folders. For drawers over 30" in width the drawer bottom panels need to be 1/2" thick.

G. Cabinets: Ends, tops, bottoms, dividers, partitions, fixed shelves, and other components not specified otherwise shall be minimum 0.745" thick.

H. Adjustable Cabinet Shelves: Provide 3/4" thick adjustable shelves except provide 1" thick shelves when shelf span exceeds 30-1/2". No shelves are to be provided over 48" long. All shelves shall be adjustable on minimum of 1-1/4".

I. Small Cubicle Shelves and Partitions: 1/4" hardboard of natural color smooth two sides, with front edges sanded.

J. Finished Backs: High-pressure decorative laminate exterior applied with cabinet liner interior. Minimum 0.745" thick.

K. Scribes and Fillers: Shall be 0.745" thick finished in decorative laminate on plywood core to match colors of adjacent cabinets.

L. Adjustable Wall Shelving: Shall be plywood, finished both surfaces with high pressure laminate, minimum 0.745" thick. Edgeband all four edges. Support wall shelves with brackets at spacing not to exceed 32" o.c., unless shown otherwise.

M. Adjustable Wall Shelving (Storage Areas): Shall be plywood, finished both surfaces with low pressure laminate, minimum 0.745" thick. Edgeband all four edges. Support wall shelves with brackets at spacing not to exceed 32" o.c., unless shown otherwise.

N. Prefinished Fixed Casework:
1. Laminating: All laminating and fabrication shall be performed in a heated and humidity conditioned environment to prevent shrinkage, warpage, and delaminations.
2. All parts shall be accurately machined and fit for square and true cases. Case joints shall be doweled with a minimum of six 10mm hardwood fluted dowels per 24" deep cabinet

joint, and shall be glued and clamped. All backs shall be dadoed into cabinet ends and furnished with 2-1/2" plywood rails at the top and bottom the full width of cabinet, concealed behind back. Rails are to be provided at a maximum spacing of 42" o.c.

3. Toe kicks shall be notched to form toe kick at 4" high. End panels to extend to the floor for maximum strength and to provide protection during shipping. The front kick board shall be of 3/4" thick plywood.
4. All base units to have a 3/4" thick solid subtop, except for sink cabinets. Subtops in open cabinets shall be finished in semi-exposed material.
5. All sink cabinets to be provided with removable backs.
6. All edges on underside of wall hung cabinets shall be edge banded.

O. Countertops: Furnish all countertops in decorative high pressure laminate, 1" thick, with 4" high backsplashes where appropriate. Provide 1" overhand at edges, unless otherwise noted. Provide 1" radii corners at all countertop outside corners at cabinet ends. Round all countertop corner ends as directed by Architect.

P. Decorative Laminate Countertops - Butt Splash 3mm Edge Banded: All decorative laminate will be high pressure, equal to or exceed in NEMA Standards for horizontal work surfaces general purpose (.050" thick). Provide 1" particleboard substrate with a minimum weight of 45 lbs. per cubic foot, with .020" thick backing sheet applied to un-exposed sides of decks and splashes. Butt style backsplashes shall be field installed using water resistant acrylic latex adhesive. All exposed edges shall be edged with 3mm PVC edge banding applied under heat and pressure. All corners of edging to be radiused 1/8" and buffed smooth. Color shall be as selected by Architect from manufacturer's premium selection of colors.

1. Unless otherwise indicated, all countertops shall be furnished 3/4" thick with 4" high backsplashes.
2. Tops shall be furnished in longest possible lengths. Field joints are factory prepared with tight joint drawer bolts. Joints, where practical, shall occur no closer than 12" to any sink or knee space. Joints shall be field installed using acrylic latex sealant. All joints and cut-outs shall be sealed with a water sealant prior to installation.
3. Countertops to be scribe fit to surrounding surfaces in neat and professional manner. All edges and corners shall be smoothly filed without presence of file marks.

Q. Coat racks - Furnish and install coat rack hooks and mounting board as shown on drawings.

R. Window Sills - Furnish and install solid surfacing window sills as specified in Section 06 46 33.

S. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:

1. Provide center matched panels at each elevation.

T. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

2.09 MUSIC INSTRUMENT STORAGE UNIT TYPE CONSTRUCTION

A. Basis of Design: Wenger Corporation Cabinet Construction 1-800-733-0393 or approved millwork company.

1. Bolt-through construction
2. Tamper-proof hardware.
3. Hinges and doors load-tested at over 300 lbs.
4. Solid polyethylene shelves.
5. Built-in front ventilation.

2.10 DISPLAY CASE

A. Sliding Glass Doors: Mount in extruded aluminum track assembly of bypass design for two equal sized leaves of tempered glass. Equip with cylinder lock mounted on ratchet lock assembly.

B. Mount doors with patch type fittings with concealed rollers or nylon runners that fit snugly in sill and head track.

C. Glass Shelving: Mount on slotted shelf standards, recessed into back or sides of cabinet as shown, with plated wire shelf supports.

D. Concealed top light: see Division 26.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

H. Site glaze glass materials using Interior Dry method; see Section 08 80 00.

I. Installation of Countertops:

1. Countertops shall be installed in as long of lengths possible. Unless impractical, no joints shall be closer than 12" to any sink or above unsupported kneespaces. Joints in plastic laminate countertops shall be factory prepared for joining using concealed clamping devices, located within 6" of front, at back edges and at intervals not exceeding 12". Joints shall be sealed and glued with polyseamseal caulking compound with clamping devices tightened to exert a constant, heavy clamping pressure and to provide flush hairline joints.
2. Countertops shall be adequately screwed to the cabinets or other supports at a minimum of 36" o.c. at front and at rear. Top mounted splashes shall be attached to countertops with polyseamseal caulking compound and #10 x1 3/4 sheet metal screws at 12" o.c. minimum.
3. Cut-outs in countertops for sinks and appliances shall be provided with radiused inside corners to resist cracking. Cut-outs shall be sealed against moisture penetration with "Thompson's Water Sealer" or equal.
4. RAD11 countertop corners where indicated on drawings.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 46 33
SOLID SURFACING WINDOW SILLS

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install solid-surfacing window sills with homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry

B. Section 06 41 00 - Architectural Wood Casework

C. Section 07 92 00 - Joint Sealants

1.03 SUBMITTALS

A. Comply with Section 01 30 00, unless otherwise indicated.

B. Product Data:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
   3. Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.

C. Shop Drawings: Installation details including location and layout of each type of fabrication and accessory.
   1. Samples: Full range of colors and patterns.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Firm experienced in installation or application of systems similar in comlexity to those required for this Project, including specific requirements indicated.
   1. Acceptable to or licensed by manufacturer.
      a. Source Limitations: Obtain materials and products from single source.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabrications appropriately wrapped in protective materials.

B. Protect fabrications from damage.

1.06 PROJECT CONDITIONS

A. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 F. for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.07 WARRANTY

A. Furnish manufacturer's limited 10 year warranty.

PART 2 - GENERAL

2.01 MANUFACTURERS

A. Corian; DuPont.

B. Gibraltar; Wilsonart.

C. Staron; Samsung.

2.02 SOLID SURFACE SHEET WINDOW SILLS

A. Nominal sheet thickness: 0.50 inch (13 mm).

B. Surface burning characteristics in accordance with ASTM E 84: Class I or A, and as follows:
   1. Flame spread: <25.
   2. Smoke developed: <25.

C. Liquid Absorption, ISO 4586-2, for ½ inch material thickness: 0.4 percent after 2 hour period.
D. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
E. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.
F. Thermal Expansion, ASTM D 696: 0.000018 inch per inch per degree F, maximum.
G. Hardness, SASTM D 2583, Barcol Impressor: 57.
H. Flexural Toughness, ASTM D 790: 3 (in.-lb,/in³).
I. Deflection Temperature under load, ASTM D 648: 90 degrees C.
J. Stain Resistance, ANSI Z-124.3 Modified; 3.4.
K. Boiling Water Resistance, NEMA LD 3-3.05.
L. High Temperature Resistance, NEMA LD 3-3.06.
M. Radiant Heat Resistance, NEMA LD 3-3.10.
N. Light Resistance, NEMA LD 3-3.03.
O. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.
P. Specific Gravity (Density ASTM D792): 1.60 grams per cubic centimeter.
Q. Approximate weight: 4.20 pounds per square foot.
R. Weatherability, ASTM D 2565.
S. Fungus Resistance, ASTM G 21.
T. Bacterial Resistance, ASTM G 22.
U. Pittsburgh Protocol Toxicity: 66.9 grams.
V. Pattern: As selected by Architect from standard patterns.
W. Finish: As selected by Architect from standard colors.
X. Patterns and Finishes: Selected from manufacturer’s full range of available selections.
Y. Thickness: 1/2" min. with bullnose drop edging at 1 1/2" front face of stool.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.02 INSTALLATION OF WINDOW SILLS

A. Install window sills full length of window, set securely into place using only concealed fasteners and manufacturer’s approved adhesive.
B. Window sills shall be plumb, true and level.
C. Provide minimum 1/8" expansion gaps on both sides of window sills, sealed with Manufacturer’s approved sealant.
   1. Ease edges and sand smooth.

END OF SECTION

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 13 00	SHEET WATERPROOFING
07 19 00	WATER REPELLENTS
07 21 00	THERMAL INSULATION
07 21 19	FOAMED-IN-PLACE INSULATION
07 27 00	AIR BARRIERS
07 41 13	METAL ROOF PANELS
07 42 13	METAL WALL PANELS
07 54 00	PVC MEMBRANE ROOFING
07 71 00	ROOF SPECIALTIES
07 72 00	ROOF ACCESSORIES
07 81 00	APPLIED FIRE PROTECTION
07 84 00	FIRESTOPPING
07 91 00	PREFORMED JOINT SEALS
07 92 00	JOINT SEALANTS
07 95 13	EXPANSION JOINT COVER ASSEMBLIES

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet Waterproofing:
   1. Self-adhered modified bituminous sheet membrane.

1.02 REFERENCE STANDARDS

A. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane.

1.04 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide ten year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Location: Lower Auditorium Floor and Elevator Shafts.
   2. Cover with protection board.

2.02 MEMBRANE MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
   2. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   3. Manufacturers:
      a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
      b. GCP Applied Technologies: www.gcpat.com/#sle.
      c. W.R. Meadows, Inc; MEL-ROL: www.wrmeadows.com/#sle.
      d. Sika Sarnafil.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

B. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Hardboard, 1/8 inch (3 mm) thick.
   2. Manufacturers:
      a. W.R. Meadows, Inc; Protection Course: www.wrmeadows.com/#sle.
      b. As recommended by GCP Applied Technologies.
      c. As recommended by Carlisle Coatings.
      d. As recommended by Sika Sarnafil.

e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Adhesives: As recommended by membrane manufacturer.

D. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

3.02 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Overlap edges and ends, minimum 3 inches (76 mm), seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

D. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

E. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

F. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

G. Seal membrane and flashings to adjoining surfaces.

3.03 FIELD QUALITY CONTROL

A. Owner will provide inspection services in accordance with Section 01 40 00 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.

B. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

1. Flood to minimum depth of 1 inch (25.4 mm) with clean water, and after 48 hours inspect for leaks.
2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
3. When area is proven watertight, drain water and remove dam.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior, masonry and concrete surfaces.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description and details of tests performed for each type of product indicated.

C. Installer's Qualification Statement.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain water repellency specified in Part 1 "Performance Requirements" Article within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. Basis of Design: Evonik, Protectosil
      a. Brick - AQUA-TRETE EM
      b. Block - CHEM-TRETE PB
      c. Pre-Cast - AQUA-TRETE EM
   2. BASF Construction Chemicals: www.buildingsystems.basf.com/#sle.
   3. Evonik Corporation: www.evonik.com/#sle.
   4. Rainguard; Micro-Seal.
   5. Textured Coatings of America, Inc: www.texcote.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:

1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Remove loose particles and foreign matter.

D. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

E. Scrub and rinse surfaces with water and let dry.

F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply two coats, minimum.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

D. Provide manufacturer's field service representative to inspect preparation and application workbefore application to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION 07 19 00

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall.

B. Batt insulation in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.04 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Board Thickness: 1-1/2 inch (38 mm).
   2. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
   3. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   4. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   5. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   6. Manufacturers:
      a. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
      b. Kingspan Insulation LLC: www.kingspan.com/#sle.
      c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FIBERBOARD INSULATION MATERIALS

A. Mineral Fiberboard Insulation: Rigid mineral fiber, in accordance with ASTM C612.
   1. Facing: None, unfaced.
   2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
   3. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
   4. Board Thickness: 1 inch (25.4 mm).
   5. Thermal Conductivity (k-factor): BTU inch/hr sq ft degrees F (W/m K) of 0.26 (0.037) per inch at 75 degrees F (24 degrees C) when tested in accordance with ASTM C518.
   6. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com/#sle.
      b. Johns Manville: www.jm.com/#sle.
      c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
      d. Knauf Insulation.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Facing: Unfaced.
   5. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com/#sle.
      b. Johns Manville: www.jm.com/#sle.
      c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
      d. Knauf Insulation.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   3. Manufacturers:
      a. Knauf Insulation: www.knaufinsulation.com/#sle.
      b. Thermafiber, Inc: www.thermafiber.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Insulation Fasteners: Appropriate for purpose intended approved by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Apply manufacturer's recommended adhesive to back of boards.

B. Install boards horizontally on foundation perimeter.

1. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.

3.03 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls.

B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2021.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

1.04 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
   1. BASF Corporation: www.spf.basf.com/#sle.
   2. Carlisle Spray Foam Insulation: www.carlislesfi.com/#sle.
   3. Icynene-Lapolla; Icynene ProSeal (MD-C-200 v3): www.icynene.com/#sle.
   4. Johns Manville: www.jm.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Thermal Resistance: R-value (RSI-value) of 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
   2. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
   3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
   4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
   5. Closed Cell Content: At least 90 percent.
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   7. Basis of Design:

a. Icynene-Lapolla; Icynene ProSeal LE: www.icynene.com/#sle.

8. Other Acceptable Manufacturers:
   a. BASF Corporation: www.spf.basf.com/#sle.
   b. Carlisle Spray Foam Insulation: www.carlislesfi.com/#sle.
   c. Johns Manville: www.jm.com/#sle.

2.03 ACCESSORIES

A. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Patch damaged areas.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

E. Trim excess away for applied trim or remove as required for continuous sealant bead.

END OF SECTION

SECTION 07 27 00
AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air barriers.

1.02 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2021.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier, Fluid Applied: Vapor semi-permeable, elastomeric waterproofing.
   1. Air Barrier Coating:
      a. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
      b. Water Vapor Permeance: 11 perms (629 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F (23 degrees C).
      c. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
      d. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
      e. 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.
      f. Comply with NFPA 285 requirements for wall assembly.
      g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
      h. VOC Content: Zero.
      i. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
      j. Products:
         1) Master Wall, Inc; Rollershield LAB System: www.masterwall.com/#sle.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Fluid-Applied Coatings or Membranes:
   1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

E. Openings and Penetrations in Exterior Air Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
   2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
   3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
   4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed steel panels.

B. Attachment system.

C. Finishes.

D. Accessories.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

C. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).

1.03 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. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Metal Roof Panels:
   1. ATAS International, Inc; Colonial Seam: www.atas.com/#sle.
   2. Berridge Manufacturing Company; M-Panel: www.berridge.com/#sle.
   3. Englert, Inc; A1300: www.englertinc.com/#sle.
   4. Firestone Building Products LLC: www.firestonebpco.com/#sle.
   5. Metl-Span, a Division of NCI Group, Inc: www.metlspan.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Soffit Panels:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. Berridge Manufacturing Company: www.berridge.com/#sle.

3. Englert, Inc: www.englertinc.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.03 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
   1. Profile: Standing seam, with minimum 1.0 inch (25 mm) seam height; concealed fastener system for field seaming with special tool.
   2. Texture: Smooth.
   3. Width: Maximum panel coverage of 24 inches (610 mm).

C. Metal Soffit Panels:
   1. Profile: Style as indicated, with venting provided.
   2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
   3. Color: As selected by Architect from manufacturer's standard line.

2.04 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FABRICATION

A. Panels: Provide factory or field fabricated panels and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss to match sample.

2.07 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, and similar sheet metal items of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib, Roof to Wall, and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil (0.55 mm) total thickness; with strippable release film and woven polypropylene sheet top surface.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

C. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Provide sealant tape or other approved joint sealer at lapped panel joints.

3.03 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.04 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, interior liner panels, and subgirt framing assembly, with related flashings and accessory components.

B. Metal trim around roll-up doors.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

D. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience and approved by manufacturer.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a twenty year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Concealed Fasteners:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. Berridge Manufacturing Company: www.berridge.com/#sle.
   3. Centria: www.centria.com/#sle.
   4. Drexel Metals Inc: www.drexmet.com/#sle.
   5. Englert, Inc: www.englertinc.com/#sle.
   6. Fabral: www.fabral.com/#sle.
   7. Firestone.
   8. MBCI.
   9. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Soffit Panels:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. Berridge Manufacturing Company: www.berridge.com/#sle.
   3. Englert, Inc: www.englertinc.com/#sle.
   4. Fabral: www.fabral.com/#sle.
   5. Firestone.
   6. MBCI.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels, interior liner panels, soffit panels, and subgirt framing assembly.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   7. Corners: Factory-fabricated in one continuous piece with minimum 2 inch (51 mm) returns.

B. Exterior Wall Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
   3. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
   4. Panel Width: 12 or 16 inches.
   5. Color: As selected by Architect from manufacturer's standard line.

C. Interior Liner Panels:
   1. Profile: Vertical; style as indicated.
   2. Side Seams: Interlocking, sealed with continuous bead of sealant.
   3. Material: Precoated steel sheet, 18 gauge, 0.0478 inch (1.21 mm) minimum thickness.
   4. Panel Width: 12 or 16 inches.
   5. Color: As selected by Architect from manufacturer's standard line.

D. Soffit Panels:
   1. Profile: Match wall panel.
   2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
   3. Color: As selected by Architect from manufacturer's standard line.

E. Subgirt Framing Assembly:
   1. Profile as indicated; to attach panel system to building.

F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

G. Expansion Joints: Same material, thickness and finish as exterior sheets; 22 gage, 0.0299 inch (0.76 mm) thick; manufacturer's standard brake formed type, of profile to suit system.

H. Parapet Cap.

I. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

J. Anchors: Galvanized steel.

K. Metal trim around heads and jambs of all roll-up doors. Coordinate with roll-up door contractor.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Precoated Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper, smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected from manufacturer’s standards.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
   1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

D. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.02 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Lap panel ends minimum 2 inches (51 mm).

F. Provide expansion joints where indicated.

G. Use concealed fasteners unless otherwise approved by Architect.

H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 CLEANING

A. Remove protective material from wall panel surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

C. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 07 54 00
PVC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mechanically attached system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Flashings.

D. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 07 71 00 - Roof Specialties: Prefabricated roofing expansion joint flashing.

1.03 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2022.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

D. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board 2017.

E. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board 2017a.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022.

G. ASTM C1484 - Standard Specification for Vacuum Insulation Panels 2010 (Reapproved 2018).

H. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing 2021.

I. FM (AG) - FM Approval Guide current edition.

J. FM DS 1-28 - Wind Design 2016.

K. NRCA (RM) - The NRCA Roofing Manual 2022.

L. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Samples for Verification: Submit two samples illustrating insulation and colored coating.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Testing firm's qualification statement.

H. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

C. Testing Firm Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.

C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
   1. Basis of Design: Sika Corporation Roofing; Sarnafil PVC: usa.sika.com/sarnafil/#sle.
   2. Provide a balanced PVC membrane with a guaranteed minimum membrane thickness meeting the above and below requirements.
   3. Base Bid: 60 mils minimum roof membrane, with minimum of 27 mils above reinforcing and a 20 year warranty.
   4. ALTERNATE Bids: Provide the following options per separate line item pricing.
      a. 72 mils minimum with minimum 34 mils above reinforcing and a 25 yr warranty.
      b. 80 mils minimum with minimum 38 mils above reinforcing and a 30 yr warranty.
   5. Substitutions: Or approved equal.

2.02 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type III, sheet contains reinforcing fibers or reinforcing fabrics.
      a. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
   2. Sheet Width:

3. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Fasteners: As recommended and approved by membrane manufacturer.

D. Flexible Flashing Material: Same material as membrane.

E. Through-Wall Flashing with Termination Bar: At least 40 mil, 0.040 inch (1.0 mm) thick poly-reinforced membrane with extruded termination bar and drip-edge.
   1. Width: 18 inches (457 mm), minimum.

2.03 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
         3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).
   2. Board Size: 48 by 96 inches (1,220 by 2,440 mm).
   3. Board Thickness: 2.0 inch (50 mm).

2.04 ACCESSORIES

A. Roofing Expansion Joint Flashing: Provide metal expansion joint covers compatible with transition if applicable where an addition connects to the existing building.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.
   2. Size: As indicated on drawings.
   3. Surface Color: Gray.
   4. Provide around roof access doors, under high roof drip edge and around mechanical equipment as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.03 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation:
   1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and FM DS 1-28 Factory Mutual requirements.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

E. Do not install more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Induction weld attached system: Roll out and position roof membrane with laps shingled where ever possible. Test weld membrane to induction weld plates to ensure proper time and temperature calibration. Locate plates then induction weld membrane to plates. Once the membrane has been secured by welds and will not move, a technician should start hot air welding lapping membrane seams with automatic welder.

D. Overlap edges and ends and seal seams by heat welding, minimum 3 inches (75 mm). Seal permanently waterproof.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.
   1. Install prefabricated joint components in accordance with manufacturer's instructions.

H. Coordinate installation of roof drains and sumps and related flashings.

3.05 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
   1. Install walkways around all sides of mechanical rooftop equipment, at roof access hatches and under eaves of high roof along drip line.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor will provide temporary construction and materials for testing.

C. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.07 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations, chemicals used for washing masonry surfaces. Cover and/or thoroughly rinse roofing surface during and after masonry cleaning

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, vents, counterflashings, and reglets.

B. Roof membrane vents.

1.02 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.

B. NRCA (RM) - The NRCA Roofing Manual 2022.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit one appropriately sized samples of each material.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Fascia, cant, and edge securement for roof membrane.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch (0.6 mm) thick, minimum.
   4. Color: To be selected by Architect from manufacturer's standard range.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch (0.6 mm) thick, minimum.
   4. Color: To be selected by Architect from manufacturer's standard range.

C. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches (102 mm), and designed to snap into thru-wall flashing or reglets with lapped joints.
   1. Material: Formed aluminum sheet, 0.032 inch (0.81 mm) thick, minimum.
   2. Material: Zinc-coated steel sheet, 0.028 inch (0.71 mm) thick, minimum.
   3. Material: Stainless steel sheet, 24 gage, 0.025 inch (0.64 mm) thick, minimum.
   4. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

F. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof curbs.

B. Equipment rails.

C. Roof penetrations mounting curbs.

D. Roof hatches, manual and automatic operation, including smoke vents.

E. Snow guards.

1.02 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 2020.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

C. FM (AG) - FM Approval Guide current edition.

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

1.03 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.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.
   5. For smoke hatches, submit evidence of approval by evaluation agency specified.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

D. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Manufacturers:
   1. AES Industries Inc: www.aescurb.com/#sle.
   2. The Pate Company: www.patecurbs.com/#sle.
   3. LMCurbs: www.lmcurbs.com/#sle.
   4. Roof Products & Systems (RPS): www.rpscurbs.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.

2. Sheet Metal Material:
    a. Aluminum: 0.080 inch (2.03 mm) minimum thickness, with 3003 alloy, and H14 temper.
        1) Color: As selected by Architect from manufacturer's standard line of colors.
    b. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gauge, 0.048 inch (1.21 mm) thick.
        1) Color: As selected by Architect from manufacturer's standard line of colors.
    c. Galvalume Steel: Hot-dip aluminum zinc alloy coated steel sheet complying with ASTM A792/A792M; AZ55 (AZM165) coating designation; 18 gauge, 0.048 inch (1.2 mm) thick.
        1) Color: As selected by Architect from manufacturer's standard line of colors.
3. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
    a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch (152 mm) clearance between curb and metal roof panel flange allowing water to properly flow past curb.
    b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
    c. Maintain at least 12 inch (305 mm) clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
    d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
4. Provide layouts and configurations indicated on drawings.

C. Equipment Support: Straight curbs on each side of equipment, with top of curbs parallel with metal roofing system and each other for equipment mounting.

D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
1. Provide sliding channel welded along top edge with adjustable height steel bracket, fabricated to fit item supported.
2. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.

2.02 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

A. Sound Rated Roof Hatch Manufacturers:
1. BILCO Company: www.bilco.com/#sle.
2. Milcor, Inc: www.milcorinc.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Hatch Manufacturers:
1. Babcock-Davis: www.babcockdavis.com/#sle.
2. Milcor, Inc: www.milcorinc.com/#sle.
3. Nystrom, Inc: www.nystrom.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Smoke and Heat Vent Manufacturers:
1. Babcock-Davis: www.babcockdavis.com/#sle.
2. BILCO Company: www.bilco.com/#sle.
3. Nystrom, Inc: www.nystrom.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

D. Roof Hatches and Smoke Vents: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
1. Sound Rated Hatches: Two sets of double leaf doors with air space between upper and lower doors; upper doors to open upward, lower doors to open downward; minimum Sound Transmission Coefficient (STC) of 45.
2. Thermally Broken Hatches: Provide insulation within frame and cover.
3. Size: As indicated on drawings; single-leaf style unless otherwise indicated.

E. Smoke and Heat Vents: Where "smoke" or "smoke/heat" operation is indicated, provide following additional features and omit manual operation for access.
   1. Smoke Release Mechanism: Automatic opening on melting of replaceable UL (DIR) listed fusible link at 165 degree F (74 degree C).
   2. UL (DIR) or FM (AG) listed as automatically operated smoke and heat vent.

F. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Mill finished aluminum, 11 gauge, 0.0907 inch (2.3 mm) thick.
   2. Insulation: Manufacturer's standard; 1 inch (25 mm) rigid glass fiber, located on outside face of curb.
   3. Curb Height: 12 inches (305 mm) from finished surface of roof, minimum.

G. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Smoke Hatches: Manual release operation not to disturb automatic release mechanisms; easy resetting by Owner's maintenance personnel; provide latch designed to prevent relatching unless automatic release mechanism has been properly reset for automatic operation.
   7. Locking: Padlock hasp on interior.

2.03 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard single pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.
   1. Brackets: Zinc plated steel.
   2. Pipe or Square Tube: Aluminum, mill finish.
      a. Outside Diameter, Round: 1 inch (25.4 mm), nominal.
      b. Threaded Couplings: Match pipe or tube, manufacturers standard.
      c. End Collars and Caps: Metal to match tube.
   3. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.
   4. Clamps for Standing Seam Roof: Aluminum clamps attached to standing seams of roof panels; for attachment of fence type snow guard.
      a. Seam Profile: Selected by Architect from manufacturer's standard range; match profile of metal roof.
   5. Manufacturers:
      a. Alpine Snow Guards; LedgeGuard-1.5 Inch Snow Guard: www.alpinesnowguards.com/#sle.
      b. PMC Industries, Inc; AceClamp - A2 Snow Retention System: www.aceclamp.com/#sle.
      c. Rocky Mountain Snow Guards, Inc; Drift II Corrugated 2-Pipe Bolt-Down Fence-Style Snow Guard Bracket: www.rockymountainsnowguards.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

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.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 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 07 81 00
APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

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

C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members 1992 (Reapproved 2020).

D. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993 (Reapproved 2020).

E. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics.

C. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Applied Fire Protection:
   1. GCP Applied Technologies: www.gcpat.com/#sle.
   2. Isolatek International Corp: www.isolatek.com/#sle.
   3. Southwest Fireproofing Products Company: www.sfrm.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLIED FIRE PROTECTION ASSEMBLIES

A. Provide assemblies as indicated on drawings.

B. Provide fire resistance ratings for following building elements as required by local building code:
   1. Floor construction, including supporting beams and joists, 2 hours.

2.03 MATERIALS

A. Applied Fire Protection Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
   1. Bond Strength: 150 pounds per square foot (7.2 kPa), minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   2. Compressive Strength: 8.33 pounds per square inch (57.4 kPa), minimum.

3. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
4. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
5. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply fireproofing in accordance with manufacturer's instructions.

B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 PERFORMANCE REQUIREMENTS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

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

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

E. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.

F. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

G. FM 4991 - Firestop Contractors 2013.

H. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

J. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
   2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
   5. Specified Technologies Inc: www.stifirestop.com/#sle.
   6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. UL-Classified Systems: CW-D.
   2. Assembly Rating: 2 hour.
   3. Linear Opening Width: As required.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
   1. UL-Classified Systems: HW-D.
   2. Assembly Rating: 1 hour.
   3. Joint width: As required.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.02 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.03 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

END OF SECTION

SECTION 07 91 00
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compression gaskets.

1.02 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

B. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements 1991 (Reapproved 2016).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

C. Color Cards: For color selection.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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

PART 2 PRODUCTS

2.01 COMPRESSION GASKETS

A. Compression Gasket: Extruded hollow polychloroprene (neoprene) gasket complying with ASTM D2628; not requiring blockout recess in substrate; not requiring vacuum to collapse seal for installation.
   1. Color: Black.
   2. Durometer Hardness, Type A: Within 55 to 65, when tested in accordance with ASTM D2240.
   3. Size and Shape: As indicated on Drawings.
   4. Measure size of existing joints before selecting seal width.
   5. Applications:
      a. Exterior wall expansion joints.
   6. Manufacturers:
      a. Balco.
      b. 3M.
      c. EMSEAL.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Compression Gaskets:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.

C. ASTM C834 - Standard Specification for Latex Sealants 2017.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

K. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

E. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

1.04 QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Stain Testing: In accordance with ASTM C1248; required only for masonry substrates.
   4. Allow sufficient time for testing to avoid delaying the work.

5. Deliver to manufacturer sufficient samples for testing.
6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
1. Bostik Inc: www.bostik-us.com/#sle.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
1. Bostik Inc: www.bostik-us.com/#sle.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
   a. Wall expansion and control joints.
   b. Joints between door, window, aluminum entrances, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Sidewalk/pavement joints.
   f. All expansion joints in pavement, walkways and curbing.
   g. All inside corners of concrete block or brick walls.
   h. Other joints indicated on drawings.
   i. Caulk all cold joints in masonry.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. All joints and cracks around wall, ceiling, and floor penetrations.
   c. Both sides and around head of exterior and interior hollow metal door frames.
   d. All inside corners of gypsum board and concrete block or brick walls.
   e. Perimeter joints of toilet fixtures.

f. Perimeter joints where drywall ceilings meet masonry walls.
g. Caulk all precast concrete unit joints and perimeter joints.
h. Caulk all cold joints in masonry.
i. Other joints indicated on drawings.

3. The types of joints that are NOT to be sealed include, but are not limited to:
a. Intentional weepholes in masonry.
b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
d. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

2.03 JOINT SEALANTS - GENERAL

A. Colors: As selected by Architect.

2.04 NONSAG JOINT SEALANTS

A. Type M - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
2. Non-Staining to Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect from manufacturer's standard range.

B. Type M - Polysulfide Sealant: ASTM C920, Grade P, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Manufacturers:
a. W.R. Meadows, Inc; Deck-O-Seal Gun Grade: www.wrmeadows.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).
2. Grade: ASTM C834; Grade NF.
3. Manufacturers:
a. Master Builders Solutions; MasterSeal NP 520: www.master-builders-solutions.com/en-us/#sle.
b. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.
3. Manufacturers:
a. Pecora Corporation; AC-20 FTR (Fire and Temperature Rated): www.pecora.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 SELF-LEVELING SEALANTS

A. Type M - Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.

B. Type M - Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Uses M and A; multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
   1. Movement Capability: Plus and minus 25 percent.
   2. Color: To be selected by Architect from manufacturer's standard range.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.02 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.
   1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
   2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

B. Resilient Seals:
   1. For Floor Joints: Any resilient material, flush, pleated, or hollow gasket.
   2. Color: Black.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

END OF SECTION

DIVISION 8 – STANDARD STEEL DOORS AND FRAMES

08 11 13	HOLLOW METAL DOORS AND FRAMES
08 14 16	FLUSH WOOD DOORS
08 31 00	ACCESS DOORS AND PANELS
08 33 23	OVERHEAD COILING DOORS
08 43 13	ALUMINUM - FRAMED STOREFRONTS
08 51 13	ALUMINUM WINDOWS
08 71 00	DOOR HARDWARE
08 80 00	GLAZING
08 83 00	MIRRORS
08 90 00	LOUVERS

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

D. Accessories, including glazing, louvers, and matching panels.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

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 2021a.

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 2018a.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

J. ITS (DIR) - Directory of Listed Products current edition.

K. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.

L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

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

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 by 2 inches (51 by 51 mm) in size, showing factory finishes, colors, and surface texture.

1.04 QUALITY ASSURANCE

A. Maintain at project site copies of reference standards relating to installation of products specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place units on minimum 4-inches (100-mm) high wood blocking. Avoid use of non-vented plastic or canvas shelters. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Architectural Building Supply.
   2. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
   4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   5. Robert I. Merrill Company.
   6. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 3 - Stile and Rail.
      d. Door Face Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal insulating door and frame assemblies and

tested in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.
    a. Unless otherwise indicated, provide thermal-rated assemblies with a U factor of 0.41 Btu/hr x sq.ft. x deg F (2.3 W/sq. m x K) or better.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
5. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 3 - Stile and Rail.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
    e. Faces: Cold-rolled sheet steel.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
4. Door Finish: Factory primed and field finished.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 3 - Stile and Rail.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    a. Attach fire rating label to each fire rated unit.
4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
6. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Face welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
2. Weatherstripping: Separate, see Section 08 71 00.
3. Heavy-duty reinforcement plate at frame head for door closer hardware to be included.

D. Interior Door Frames, Non-Fire Rated: Face welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
2. Heavy-duty reinforcement plate at frame head for door closer hardware to be included.

E. Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
3. Heavy-duty reinforcement plate at frame head for door closer hardware to be included.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

2.06 ACCESSORIES

A. Glazing Stops: Minimum 0.04-inch (1.0-mm) steel or 0.040-inch (1.0-mm) thick aluminum.

1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

B. Astragals for Double Doors: Specified in Section 08 7100.

C. Silencers: Resilient rubber, {CH#47531}; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. In masonry construction, locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry tee anchors.

E. At existing concrete or masonry construction, provide 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb, set frames and secure to adjacent construction with bolts and masonry anchorage devices.

F. Install door hardware as specified in Section 08 71 00.

G. Touch up damaged factory finishes.

3.02 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.03 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing.

E. Section 09 91 23 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

D. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door veneer, 3 by 5 inches ([___] by [___] mm) in size illustrating wood grain, stain color, and sheen.

E. Warranty, executed in Owner's name.

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.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Oshkosh Door.
   2. VT Industries Inc.
   3. Weyerhaeuser Company.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, HPVA Grade A, plain sliced (flat cut), with book match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges(Hardwood Edge - NOT VENEER): Same species as face veneer.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement - 1 1/2 inch minimum hardwood at both sides of door.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
   1. Transparent:
      a. System - TR-6, Catalyzed Polyurethane.
      b. Stain: As selected by Architect.
      c. Sheen: Semigloss.

B. Factory finish doors in accordance with approved sample.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 11 13.

B. Glazing: See Section 08 80 00.

C. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim maximum of 3/4 inch (19 mm) off bottom edges.
   3. Trim fire-rated doors in strict compliance with fire rating limitations.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

3.02 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.03 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION 08 14 00

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling mounted access units.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Samples: Submit two access units illustrating frame configuration and face material.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Ceiling-Mounted Units:
   1. Location: As indicated on drawings.
   2. Panel Material: Steel.
   3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
   4. Size - Other Ceilings: 12 by 12 inches (305 by 305 mm) in gypsum board ceiling locations.
   5. Size - Exterior Soffits: 18 by 18 inches in metal soffit areas shown on plans.
   6. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 CEILING-MOUNTED UNITS

A. Manufacturers:
   1. Babcock-Davis: www.babcockdavis.com/#sle.
   2. Bilco Company
   3. Elmdor Stonemen: www.elmdorstoneman.com/#sle.
   4. J. L. Industries, Inc.
   5. Milcor, Inc: www.milcorinc.com/#sle.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
   2. Door Style: Single thickness with rolled or turned in edges.
   3. Frames: 16 gauge, 0.0598 inch (1.52 mm), minimum thickness.
   4. Steel Finish: Primed.
   5. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
   6. Door/Panel Size: As indicated on the drawings.
   7. Hardware:
      a. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
      b. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
      c. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
      d. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

3.02 ADJUSTING

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 08 31 13

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior coiling doors.

B. Interior non-fire-rated coiling doors.

C. Fire-rated coiling doors.

D. Electric operators and control stations.

E. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Power to disconnect.

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 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ITS (DIR) - Directory of Listed Products current edition.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

H. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

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

J. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

K. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
   2. The Cookson Company: www.cooksondoor.com/#sle.
   3. Overhead Door Corporation..

4. Raynor.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa) without undue deflection or damage to components.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
   3. Nominal Slat Size: 2 inches (50 mm) wide by required length.
   4. Finish: Factory painted, color as selected by Architect
   5. Guide, Angles: Galvanized steel.
   6. Hood Enclosure: Manufacturer's standard; powder-coated, color as selected by Architect.
   7. Electric operation.
   8. Mounting: Within framed opening.
   9. Locking Devices: Lock and latch handle on outside.

B. Interior Non-Fire-Rated Coiling Doors: Steel slat curtain.
   1. Single Thickness Slats: Manufacturer's standard.
   2. Nominal Slat Size: 2 inches (50 mm) wide by required length.
   3. Finish: Factory painted, color as selected by Architect.
   4. Guides, Angles: Galvanized steel.
   5. Hood Enclosure: Manufacturer's standard; powder-coated, color as selected by Architect.
   6. Electric operation.
   7. Mounting: Within framed opening.
   8. Locking Devices: Lock and latch handle on outside.

C. Fire-Rated Coiling Doors: Steel slat curtain; comply with NFPA 80.
   1. 1-1/2 hour fire rating.
   2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for purpose specified and indicated on drawings.
   3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
   4. Nominal Slat Size: 2 inches (50 mm) wide by required length.
   5. Finish: Factory painted, color as selected.
   6. Guides, Angles: Galvanized steel.
   7. Hood Enclosure: Manufacturer's standard; powder-coated, color as selected by Architect.
   8. Fire Alarm Release Mechanism: Electric-motor operated from fire alarm system and local heat or smoke detectors.
      a. Provide fail-secure, fail-closed, locking device upon power loss.
      b. Provide 10 second time delay for activation upon loss of power.
      c. Provide resettable device without replacement of parts, except when release triggered by exposure to local heat.
   9. Electric operation.
   10. Mounting: Within framed opening.
   11. Locking Devices: Lock and latch handle on outside.

2.03 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   4. Smoke Seals: Provide brush or gasket type weatherstripping seals to prevent passage of smoke and hot gases in compliance with UL 1784 testing requirements.

5. Steel Slats for Exterior Insulated Doors: Minimum thickness, 24 gauge, 0.024 inch; ASTM A653/A653M galvanized steel sheet.
6. Steel Slats for Interior Non-Insulated Doors: Minimum thickness, 22 gauge, 0.030 inch; ASTM A653/A653M galvanized steel sheet.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
1. Hot-dip galvanized in compliance with ASTM A123/A123M.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

E. Lock Hardware:
1. Cylindrical Locking Mechanism: Latchset lock cylinder, specified in Section 08 71 00.
2. For motor operated units, additional lock or latching mechanisms are not required.
3. Latch Handle: Manufacturer's standard.

F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
1. Provide interlock switches on motor operated units.

B. Electric Operators:
1. Mounting: Side mounted.
2. Motor Enclosure:
3. Motor Rating: 1/3 HP (250 W); continuous duty.
4. Motor Voltage: 120 volts, three phase, 60 Hz.
5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
6. Controller Enclosure: NEMA 250, Type 4.
7. Opening Speed: 12 inches per second (300 mm/sec).
8. Brake: Manufacturer's standard type, activated by motor controller.
9. Manual override in case of power failure.
10. See Section 26 05 83 for electrical connections.

C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
2. Surface mounted, at interior door jamb.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Install smoke door assemblies in accordance with NFPA 105.

D. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

E. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

F. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

G. Coordinate installation of electrical service with Section 26 05 83.

H. Complete wiring from disconnect to unit components.

I. Complete wiring from fire alarm system.

J. Install enclosure and perimeter trim.

3.03 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.04 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of metal.

C. Aluminum doors and frames.

D. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

B. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

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

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

I. 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.

J. 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).

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer North America; 451T TriFab Framing.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. C.R. Laurence Company, Inc; U.S. Aluminum; Series 450, 451, 451T, and 850: www.crl-arch.com/#sle.
   2. EFCO, a Pella Company; S402 & S403/Thermal: www.efcocorp.com/#sle.
   3. Tubelite, Inc., 400 series.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Not Thermally-Broken:
   1. Basis of Design: Kawneer North America; 350 Doors.
   2. Thickness: 2 inches (51 mm).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO, a Pella Company; Series D518 Durastile Door: www.efcocorp.com/#sle.
   2. Tubelite, Inc., 400 series.
   3. Vistawall International.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   2. Finish Color: As selected by Architect from manufacturer's standard line.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Positive Design Wind Load: 20 lbf/sq ft (958 Pa).
      b. Negative Design Wind Load: 20 lbf/sq ft (958 Pa).
      c. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
   3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   5. Overall U-value Including Glazing: 0.69 Btu/(hr sq ft deg F) (W/(sq m K)), maximum.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Finish: Same as storefront.

C. Swing Doors: Glazed aluminum.
   1. Finish: Same as storefront.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; shop primed.

D. Fasteners: Stainless steel.

E. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: See Section 08 80 00.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Color: As selected by Architect from manufacturer's standard range.

2.07 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: See Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

F. Silencers: BHMA A156.16, Grade 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash and operating sash.

B. Factory glazing.

C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

G. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Installer's qualification statement.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum Windows:
   1. EFCO, a Pella Company: www.efcocorp.com/#sle.
   2. Kawneer North America.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Frame Depth: 3-1/2 inch (89 mm).
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F (82.2 degrees C) surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

B. Fixed, Non-Operable Type:
   1. Construction: Thermally broken for exterior applications, non-thermally broken for interior applications.
   2. Glazing: Single; clear; transparent.
   3. Exterior Finish: Class I color anodized.
   4. Interior Finish: Class I color anodized.

C. Horizontal Sliding Type:
   1. Construction: Non-thermally broken.
   2. Glazing: Single; clear; transparent.
   3. Exterior Finish: Class I color anodized.
   4. Interior Finish: Class I color anodized.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): CW.

B. Design Pressure (DP): In accordance with ASCE 7.

C. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.

D. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf (580 Pa).

E. Air Leakage: 0.1 cfm/sq ft (0.5 L/sec sq m) maximum leakage per unit area of outside window frame dimension when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

F. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

G. Forced Entry Resistance: Tested to comply with ASTM F588 requirements for performance level of Grade 10 for specific window style required.

2.04 COMPONENTS

A. Frames: Dimensions as shown on drawings; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.

B. Glazing: See Section 08 80 00.

C. Reinforced Mullion: Extruded aluminum with integral reinforcement of shaped steel structural section.

D. Glazing Materials: See Section 08 80 00.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 HARDWARE

A. Sash lock: Lever handle with cam lock.

B. Pulls: Manufacturer's standard type.

C. Bottom Rollers: Stainless steel, adjustable.

D. Limit Stops: Resilient rubber.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Finish Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 PRIME WINDOW INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

E. Install sill and sill end angles.

F. Set sill members and sill flashing in continuous bead of sealant.

G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install operating hardware not pre-installed by manufacturer.

I. Install glass and infill panels in accordance with requirements; see Section 08 80 00.

3.02 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.03 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.

1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Related Sections:

1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
4. Division 8: Wood Doors.
5. Division 26 Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. ICC – International Building Code

D. Intent of Hardware Groups

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

E. Allowances

1. Refer to Division 1 for allowance amount and procedures.

F. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.

1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.

a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Name, address, and phone number of local representative for each manufacturer.
d. Parts list for each product.

2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed “Wiring Diagrams” for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.

    a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
    b. Hardware Schedule shall be prepared and signed by an AHC.

4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

    a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
    b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer’s Warranty:

1. Closers: Lifetime

2. Exit Devices: Five Years
3. Cylindrical Locksets & Cylinders: Ten years
4. Mortise Lockset: Lifetime
5. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

Item:	Manufacturer:
Hinges	Stanley
Continuous Hinges	ABH
Locksets	Best
Cylinders	Best
Exit Devices	Precision
Closers	Stanley
Push/Pull Plates	Trimco
Push/Pull Bars	Trimco
Protection Plates	Trimco
Overhead Stops	ABH
Door Stops	Trimco
Flush Bolts	Trimco
Coordinator & Brackets	Trimco
Threshold & Gasketing	National Guard

2.2 MATERIALS:

A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.

4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Fit ANSI A115.1 door preparation
5. Functions and design as indicated in the hardware groups
6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
10. Provide sufficient curved strike lip to protect door trim
11. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
12. Lock shall have self-aligning, thru-bolted trim
13. Levers to operate a roller bearing spindle hub mechanism
14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
15. Spindle to be designed to prevent forced entry from attacking of lever
16. Provide locksets with 7-pin removable and interchangeable core cylinders
17. Each lever to have independent spring mechanism controlling it
18. Core face must be the same finish as the lockset.
19. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. - Best 45H Series
    b. No Substitution

D. Cylindrical Type Locks and Latchsets:

1. Provide locksets tested and approved by BHMA/ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty.
2. Provide locksets listed by Underwriters Laboratories for use on fire rated single or double swinging doors.
3. Provide locksets that meet the design and operation of the cylindrical lock to meet the accessible requirements of ANSI A117.1 and ADA–Americans with Disabilities Act.
4. Provide locksets that meet Florida Building Code and Miami-Dade County Code:
    a. 9/16” latch throw – Listed by Florida Building Code and Miami-Dade County at ± 75 PSF for single doors.
    b. 3/4” latch throw – Listed by Florida Building Code and Miami Dade County at ± 80 PSF for single doors and ± 50 PSF for double doors.
5. Provide locksets that are listed with the California State Fire Marshal.
6. Provide locksets made in a manufacturing facility to compliant with ISO 9001-Quality Management and ISO 14001-Environmental Management.
7. Provide locksets that meet or exceed 50 Million cycle test verified by third party testing agency.
8. Provide locksets with the following mechanical features
    a. Locksets outside locked lever must withstand minimum 1400 inch-pounds of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
    b. Locksets shall fit modified ANSI A115.2 door preparation.
    c. 2-3/4 inch (70 mm) backset, standard.
    d. Door thickness – Available for 1 3/8” to 2 1/4” doors.
    e. 9/16 inch (14 mm) throw latchbolt.
    f. Latch to have single piece tail-piece construction.
    g. Chassis – Critical latch and chassis components to be brass or corrosion-treated steel.
    h. Lock shall allow the lever handle to move 45 degrees from parallel to the horizontal plane without engaging the latchbolt assembly.
    i. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
    j. Locksets to have anti-rotational studs that are thru-bolted.
    k. Provide sufficient curved strike lip to protect door trim at single doors. At pairs of doors, provide 7/8” Lip to Center Strike.
    l. Each lever to have independent spring mechanism.
    m. Lever springs to be contained in the main lock hub.
    n. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy.
    o. Keyed lever to be removable only after core is removed, by authorized control key.
    p. Abrasive lever handles to have a special abrasive strip on back of the hand grasp portion of the lever.
    q. Tactile lever handles to have grooves machined into the back of the hand grasp portion of the lever.
9. Locksets to have the capability of supporting manufacturers’ conventional core as well as large and small interchangeable cores.
10. Provide core face with the same finish as the lockset.
11. Provide functions and design as indicated in the hardware groups.
12. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. - Best 9K Series
    b. No Substitution

E. Mortise Deadbolt:
1. Tested and approved by ANSI A156.36, Operational Grade 1.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. 2-3/4 inch (70mm) backset
5. 1 inch throw deadbolt
6. Provide locksets with 7-pin core.
7. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. - Best 48H Series

b. No Substitution

F. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking ¾" through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have ¼" minimum turn hex key dogging.
8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a ¼" clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Exit Device Intruder Function Visual Indicator is to be used in conjunction with the ANSI "10" Function, which allows the outside lever trim to be locked from the inside while the door remains closed. Rim cylinder on the exterior/trim side retracts the latch from the outside.
    a. Indicator to be actuated by a rim cylinder equipped with a keyed core or thumb-turn.
    b. Directional indicator feature shall have a large status indicator window with directional pointer embossed into the active case cover to indicate key turn direction to lock and unlock outside lever trim. Labels or stickers are not acceptable.
    c. The status indicator window shall be integrated into the housing of the exit device and is to contain bright reflective material that may be seen in low light conditions.
    d. Indicator window to be protected by impact resistant lens cover.
    e. The action to lock down/unlock shall require a quarter turn (90°) of key or thumb turn.
        1) Locked status shall be indicated by a red indicator that will appear under the lens cover with an image of a locked padlock.
        2) Unlocked status shall be indicated by a green indicator that will appear under the lens of the cover with an image of an unlocked padlock.
19. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. – Precision Apex 2000 Series
    b. No Substitution

G. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.
4. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. - Best 1E Series
    b. No Substitution

H. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½“ minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.
12. Acceptable manufacturers and/or products:
    a. dormakaba USA Inc. – Stanley QDC100K Series
    b. No Substitution

I. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

J. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.

1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
2. Surface overhead stops shall be heavy duty bronze or stainless steel.

K. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

L. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

M. Push Pull Bars: Provide ANSI J504, .1” Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.

N. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

O. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

P. Door Bolts: Flush bolts for wood or metal doors.

1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

Q. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.

1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.

2. Provide mounting brackets for soffit applied hardware.
3. Provide hardware preparation (cutouts) for latches as necessary.

R. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

S. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.

1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.

T. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.

1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
2. UL10C Positive Pressure rated seal set when required.

U. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.

C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.

E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys
2. 4 each Masterkeys
3. 2 each Change keys each keyed core

4. 15 each Construction masterkeys
5. 1 each Control keys

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).

2. Recommended locations for Architectural Hardware for flush wood doors (DHI).

3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.

1. Check and adjust closers to ensure proper operation.

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.

   a. Verify levers are free from binding.
   b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

Code	Name
AB	ABH Manufacturing Inc.
AD	Adams Rite
BE	Best Access Systems
BY	By Related Section
DM	Dorma Door Controls
NA	National Guard
PR	Precision
SH	Stanley Commercial Hardware
ST	Stanley
STAN	Stanley
TR	Trimco

Option List

Code	Description
1/4-20 SSMS/EA	STAINLESS MACHINE SCREWS/EXPANSION ANC.
B4E-HEAVY-KP	BEVELED 4 EDGES - KICK PLATES
CD	CYLINDER DOGGING
CSK	COUNTER SINKING OF KICK and MOP PLATES
G	Back-to-Back Mounted
J	Concealed Mtd.
LBR	LESS BOTTOM ROD
VIB	Double Visual Indictor Option

Finish List

Code	Description
32D	Satin Stainless Steel
600	Primed for Painting
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
US32D	Stainless Steel, Dull

SECTION 08 71 00
DOOR HARDWARE GROUPS

Set #1.0
Doors: A136

6	Butt Hinge	FBB199 4.5" x 4.5" NRP	32D	ST
1	Removable Mullion	KR822	600	PR
1	Exit Device	2103 X 4903A CD NCA-03	630	PR
1	Exit Device	2102 X 4902A CD	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
2	Rim Cylinder	12E-72 PATD	626	BE
2	Door Closer - Cush Stop	QDC119	689	SH
2	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Mullion Seal	5100N		NA
1	Drip Cap	16 A - 4" ODW		NA
2	Weatherstrip	160SA Head & Jambs		NA
2	Door Sweep	200NA		NA
2	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #1.1
Doors: A100

2	Continuous Hinge	A110HDC		AB
1	Exit Device	2403 CD NCA-03	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
1	Ladder Pull	AP436 36" J	630	TR
1	Auto Operator	ED100LE	689	DM
1	Electric Strike	0162	630	RC
1	Power Supply	DKPS-2A		RC
2	Wall Actuators	910TC WRM-WRB	630	RC
2	Floor Stop	1209HA	630	TR
1	Card Reader	Provided by Owners Security Integrator		BY
1	Drip Cap	16 A - 4" ODW		NA
1	Integral Seals	by Door/Frame Mfg.		BY
2	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

NOTE: Doors are normally closed and locked. Access is gained with valid credentials. Program auto operator times of operation per District’s direction.

Set #1.2
Doors: A100A

3	Continuous Hinge	A110HDC		AB
1	Removable Mullion	WS1310-8	628	DM
2	Exit Device	2403 CD NCA-03	630	PR
1	Exit Device	2402 X CD	630	PR
3	Mortise Cylinder	1E-74 PATD	626	BE
2	Rim Cylinder	12E-72 PATD	626	BE
3	Ladder Pull	AP436 36" J	630	TR
3	Door Closer - Rw/PA	QDC111	689	SH
3	Floor Stop	1209HA	630	TR
1	Integral Seals	by Door/Frame Mfg.		BY

NOTE: Field verify existing conditions.

Set #2.0

Doors: B111, C122

2	Continuous Hinge	A110HDC		AB
1	Removable Mullion	WS1310-8	628	DM
1	Exit Device	2403 CD NCA-03	630	PR
1	Exit Device	2402 X CD	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
2	Ladder Pull	AP436 36" J	630	TR
2	Door Closer - Rw/PA	QDC111	689	SH
2	Floor Stop	1209HA	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Integral Seals	by Door/Frame Mfg.		BY
2	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #2.1

Doors: B100, D145

2	Continuous Hinge	A110HDC		AB
1	Exit Device	2403 CD NCA-03	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
1	Ladder Pull	AP436 36" J	630	TR
1	Auto Operator	ED100LE	689	DM
1	Electric Strike	0162	630	RC
1	Power Supply	DKPS-2A		RC
2	Wall Actuators	910TC WRM-WRB	630	RC
2	Floor Stop	1209HA	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Integral Seals	by Door/Frame Mfg.		BY
2	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #2.2

Doors: C100

2	Continuous Hinge	A110HDC		AB
1	Exit Device	2403 CD NCA-03	630	PR
1	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
1	Ladder Pull	AP436 36" J	630	TR
1	Door Closer - Rw/PA	QDC111	689	SH
1	Floor Stop	1209HA	630	TR
1	Integral Seals	by Door/Frame Mfg.		BY
2	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #3.0

Doors: A116, B106, B107A, B111A, C117, C119, C126, D118, D119, D141, D143

3	Butt Hinge	FBB199 4.5" x 4.5" NRP	32D	ST
1	Exit Device	2103 X 4903A CD	630	PR
1	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	160SA Head & Jambs		NA
1	Door Sweep	200NA		NA
1	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #4.0
Doors: D144

6	Butt Hinge	FBB199 4.5" x 4.5" NRP	32D	ST
2	Manual Flushbolt	3917-12	626	TR
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Overhead Stop	4420 Series	US32D	AB
2	Kick Plate	K0050 10" x 1" LDW B4E CSK	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	160SA Head & Jambs		NA
1	Astragal	139SP		NA
2	Door Sweep	200NA		NA
1	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #5.0
Doors: D142

3	Butt Hinge	FBB199 4.5" x 4.5" NRP	32D	ST
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Overhead Stop	4420 Series	US32D	AB
1	Lock Astragal	5002	630	TR
1	Drip Cap	16 A - 4" ODW		NA
1	Weatherstrip	160SA Head & Jambs		NA
1	Door Sweep	200NA		NA
1	Handicap Threshold	513A 1/4-20 SSMS/EA	AL	NA

Set #6.0 - NOT USED

Set #7.0
Doors: B112, C123

2	Continuous Hinge	A110HDC		AB
2	Dummy Bar	671DR-3	630	PR
2	Ladder Pull	AP436 36" J	630	TR
2	Door Closer - Rw/PA	QDC111	689	SH
2	Floor Stop	1209HA	630	TR
2	Integral Seals by Door/Frame Mfg.		BY	

Set #7.1
Doors: B101, D146

2	Continuous Hinge	A110HDC		AB
2	Dummy Bar	671DR-3	630	PR
2	Ladder Pull	AP436 36" J	630	TR
1	Auto Operator	ED100LE	689	DM
1	Door Closer - Rw/PA	QDC111	689	SH
2	Wall Actuators	910TC WRM-WRB	630	RC
2	Floor Stop	1209HA	630	TR
2	Integral Seals by Door/Frame Mfg.		BY	

Set #8.0

Doors: A112, A113, A127, B120, B155A, B210A,C108, C116, C204

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Exit Device	2208 X 4908A CD LBR	630	PR
1	Exit Device	2201 CD LBR	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
2	Door Closer - Cush Stop	QDC119	689	SH
2	Magnetic Holders	2300	S1	AB
2	Kick Plate	K0050 10" x 1" LDW B4E CSK	630	TR
1	Astragal Seal	5070B		NA
1	Gasketing	5050B Head & Jambs		NA

Note: Tie magnetic holders to fire alarm panel to release upon alarm.

Set #8.1

Doors: D100, D101, D104, D105, D106, D114, D115, D123, D124, D134, D204, D205, D206

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Exit Device	2208 X 4908A CD LBR	630	PR
1	Exit Device	2201 CD LBR	630	PR
2	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
2	Door Closer – Rw/PA	QDC111	689	SH
2	Kick Plate	K0050 10" x 1" LDW B4E CSK	630	TR
2	Wall Stops	1270CVSV	626	TR
2	Floor Stop	1209	630	TR
1	Astragal Seal	5070B		NA
1	Gasketing	5050B Head & Jambs		NA

NOTE: Use wall or floor stop stop as best fits each opening.

Set #9.0

Doors: A202

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Manual Flushbolt	3917-12 (Top Bolt only)	626	TR
1	Deadlock	48H-7R PATD	626	BE
4	Ladder Pull	AP436 36" G	630	TR
2	Door Closer - Cush Stop	QDC119	689	SH
2	Kick Plate	K0050 10" x 1" LDW B4E CSK	630	TR
1	Astragal Seal	5070B		NA
1	Gasketing	5050B Head & Jambs		NA

Set #10.0

Doors:D109

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Exit Device	2108 X 4908A CD	630	PR
1	Mortise Cylinder	1E-74 PATD	626	BE
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Gasketing	5050B Head & Jambs		NA

Set #11.0 - NOT USED

Set #12.0
Doors: A114, D133

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Manual Flushbolt	3917-12 (Top Bolt only)	626	TR
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Overhead Stop	4420 Series	US32D	AB
2	Kick Plate	K0050 10" x 1" LDW B4E CSK	630	TR
1	Astragal	158NA		NA
1	Gasketing	5050B Head & Jambs		NA

Set #13.0
Doors: D130

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Manual Flushbolt	3917-12 (Top Bolt only)	626	TR
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Door Closer - Rw/PA	QDC111	689	SH
1	Overhead Stop	4420 Series	US32D	AB
1	Wall Bumper	1270CVSV	626	TR
1	Astragal	158NA		NA
1	Gasketing	5050B Head & Jambs		NA

Set #13.1
Doors: D132

6	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Manual Flushbolt	3917-12 (Top Bolt only)	626	TR
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Overhead Holder	4410 Series	US32D	AB
1	Astragal	158NA		NA
1	Gasketing	5050B Head & Jambs		NA

Set #14.0 - NOT USED

Set #15.0
Doors: B102, B103, B104, B105, B109, B119, B201, B202, B203, B204, B205, C109, C111, C130, C200, C202, C205, C206, C209, C210

3	Butt Hinge	FBB191 4.5" x 4.5" NRP	32D	ST
1	Security Classroom Lockset	9K3-7IN15D PATD	626	BE
1	Door Closer - EDA	QDC115	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #16.0 - NOT USED

Set #16.1
Doors: B116, C110, C116A

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Security Classroom Lockset	9K3-7IN15D PATD	626	BE
1	Door Closer – Rw/PA	QDC111	689	SH
1	Magnetic Holder	2300	S1	AB
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Gasketing	5050B Head & Jambs		NA

Set #17.0
Doors: A109, A111, A118, A137, A143, B206, D108, D129A

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Office/Entry Lockset	9K3-7AB15D PATD	626	BE
1	Door Closer - EDA	QDC115	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Dome Stop	1211	626	TR
1	Gasketing	5050B Head & Jambs		NA

NOTE: Use wall or floor stop as best fits each opening.

Set #18.0
Doors: A110, A119, B211, C102, C105

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Office/Entry Lockset	9K3-7AB15D PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Gasketing	5050B Head & Jambs		NA

Set #19.0
Doors: A200A, A205, D149, D200

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Door Closer - Cush Stop	QDC119	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Gasketing	5050B Head & Jambs		NA

Set #20.0
Doors: A135, A138, A146, C115, D125A, D126, D128

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Door Closer - Rw/PA	QDC111	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #21.0
Doors: A140, A142, C120, C125, D134

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Passage Set	9K3-0N15D	626	BE
1	Door Closer - EDA	QDC115	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR

1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #22.0
Doors: A139, A139A, A141, A141A, C121, C124, C127, D135

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Deadlock	48H-7R PATD	626	BE
1	Pull Plate	1017-3B	630	TR
1	Push Plate	1001-9	630	TR
1	Door Closer - EDA	QDC115	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #23.0
Doors: A123

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Deadlock	48H-7R PATD	626	BE
1	Pull Plate	1017-3B	630	TR
1	Push Plate	1001-9	630	TR
1	Door Closer - Holder/Stop	QDC120	689	SH
1	Kick Plate	K0050 10" x 2" LDW B4E CSK	630	TR
1	Gasketing	5050B Head & Jambs		NA

Set #24.0
Doors: A100B, A200

1	Continuous Hinge	A110HDC		AB
1	Deadlock	MS1850SN	628	AD
1	Mortise Cylinder	1E-74 PATD	626	BE
1	Thumb Turn Cylinder	1EA-6A4	626	BE
1	Door Pull	1747-1	628	TR
1	Door Closer - EDA	QDC115	689	SH
1	Dome Stop	1211	626	TR
1	Wall Bumper	1270CVSV	626	TR
1	Spacer Block	P45HD-110	628	ST
1	Integral Seals	by Door/Frame Mfg.		BY

NOTE: Use floor or wall stop as best fits each opening.

Set #25.0
Doors: A101, A102, A106, A107, A129, A145, A201, B117, B118, C106, C107, D139

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Office/Entry Lockset	9K3-7AB15D PATD	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #26.0

Doors: A104, A105, A115, A124, A125, A134, B114, B209, C113, C114, C118, C203, C208, D111, D125, D129, D201, D202

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Overhead Stop	4420 Series	US32D	AB
1	Gasketing	5050B Head & Jambs		NA

Set #27.0

Doors: A103A,A117, A128, A132, A204, B108, B110, B113, B200, B207, B208, B212, B213, C103, C112, C131, C132, C133, C201, C207, C211, D122, D136, D137, D138, D207

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Storeroom Lockset	9K3-7D15D PATD	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #28.0

Doors: A108, A110A, A130, B115, B210, C128, C129, D113, D140

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Privacy Set	45H-0L15H VIB	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Set #29.0

Doors: D110, D112, D117, D120, D121

3	Butt Hinge	FBB191 4.5" x 4.5"	32D	ST
1	Passage Set	9K3-0N15D	626	BE
1	Wall Bumper	1270CVSV	626	TR
1	Gasketing	5050B Head & Jambs		NA

Opening	Hdw Set	Opening Label	Door Type	Frame Type
A100	1.1			
A101	25.0			
A102	25.0			
A103	27.0			
A104	26.0			
A105	26.0			
A106	25.0			
A107	25.0			
A108	28.0			
A109	17.0			
A110	18.0			
A111	17.0			
A112	8.0			
A113	8.0			
A114	12.0			
A115	26.0			
A116	3.0			
A117	27.0			
A118	17.0			
A119	18.0			
A123	23.0			
A124	26.0			
A125	26.0			
A127	8.0			
A128	27.0			
A129	25.0			
A130	28.0			
A132	27.0			
A134	26.0			
A135	20.0			
A136	1.0			
A137	17.0			
A138	20.0			
A139	22.0			
A140	21.0			
A141	22.0			
A142	21.0			
A143	17.0			
A145	25.0			
A146	20.0			
A200	24.0			
A201	25.0			
A202	9.0			
A204	27.0			
A205	19.0			
B100	2.1			
B101	7.1			
B102	15.0			
B103	15.0			
B104	15.0			
B105	15.0			
B106	3.0			
B108	27.0			
B109	15.0			
B110	27.0			
B111	2.0			
B112	7.0			

B113	27.0
B114	26.0
B115	28.0
B116	16.1
B117	25.0
B118	25.0
B119	15.0
B120	8.0
B200	27.0
B201	15.0
B202	15.0
B203	15.0
B204	15.0
B205	15.0
B206	17.0
B207	27.0
B208	27.0
B209	26.0
B210	28.0
B211	18.0
B212	27.0
B213	27.0
C100	2.2
C102	18.0
C103	27.0
C104	28.0
C105	18.0
C106	25.0
C107	25.0
C108	8.0
C109	15.0
C110	16.1
C111	15.0
C112	27.0
C113	26.0
C114	26.0
C115	20.0
C116	8.0
C117	3.0
C118	26.0
C119	3.0
C120	21.0
C121	21.0
C122	2.0
C123	7.1
C124	22.0
C125	21.0
C126	3.0
C127	22.0
C128	28.0
C129	28.0
C130	15.0
C131	27.0
C132	27.0
C133	27.0
C200	15.0
C201	27.0
C202	15.0
C203	26.0
C204	8.0
C205	15.0

C206	15.0
C207	27.0
C208	26.0
C209	15.0
C210	15.0
C211	27.0
D100	8.1
D101	8.1
D102	25.0
D103	25.0
D104	8.1
D105	8.1
D106	8.1
D108	17.0
D109	10.0
D110	29.0
D111	26.0
D112	29.0
D113	28.0
D114	8.1
D115	8.1
D116	27.0
D117	29.0
D118	3.0
D119	3.0
D120	29.0
D121	29.0
D122	27.0
D123	8.1
D124	8.1
D125	26.0
D126	26.0
D128	26.0
D129	26.0
D130	13.0
D131	8.1
D132	13.1
D133	12.0
D134	8.1
D135	22.0
D136	27.0
D137	27.0
D138	27.0
D139	25.0
D140	28.0
D141	3.0
D142	5.0
D143	3.0
D144	4.0
D145	2.1
D146	7.1
D149	19.0
D200	19.0
D201	26.0
D202	26.0
D203	26.0
D204	8.1
D205	8.1
D206	8.1
A100B	24.0
A101A	1.2

A103A	27.0
A110A	28.0
A139A	22.0
A141A	22.0
A200A	19.0
B107A	3.0
B111A	3.0
B155A	8.0
B210A	8.0
C116A	16.1
D125A	20
D129A	17.0

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

D. Section 08 51 13 - Aluminum Windows: Glazing provided by window manufacturer.

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 C920 - Standard Specification for Elastomeric Joint Sealants 2018.

D. ASTM C1036 - Standard Specification for Flat Glass 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

J. GANA (GM) - GANA Glazing Manual 2008.

K. GANA (SM) - GANA Sealant Manual 2008.

L. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

N. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 x 12 inch in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.04 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, Manufacturer's standard corners.
   4. Spacer Color: Aluminum.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
      b. Color: Black.
   6. Purge interpane space with dry air, hermetically sealed.

B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Gray.
      b. Coating: Clear, on #2 surface.
      c. Fully tempered panels as required, see plans.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E Solarban 60 (solar control type), on #3 surface.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.50, nominal.

C. Type IG-2 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Interior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Fully tempered panels as required, see plans.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.50, nominal.

D. Insulating Glass Units: Spandrel glazing.
   1. Applications: Exterior spandrel glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Gray.
      b. Coating: Same as on vision units, on #2 surface.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
      b. Opacifier: Ceramic frit, on #4 surface.
      c. Opacifier Color: Black.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.50, nominal.

2.05 GLAZING UNITS

A. Type G-3 - Monolithic Safety Glazing: Non-fire-rated.

1. Applications:
    a. Glazed lites in doors, except fire doors.
    b. Glazed sidelights to doors, except in fire-rated walls and partitions.
    c. Glazed panels with beveled edges at decorative metal balcony railings at commons area, auditorium stairs.
    d. Other locations required by applicable federal, state, and local codes and regulations.
    e. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

2.06 GLAZING COMPOUNDS

A. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

B. Manufacturers:
1. Dow Corning Corporation; Dow corning 795: www.dowcorning.com/construction/#sle.
2. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
1. Width: As required for application.
2. Thickness: As required for application.
3. Spacer Rod Diameter: As required for application.
4. Manufacturers:
    a. Pecora Corporation: www.pecora.com/#sle.
    b. Tremco Global Sealants: www.tremcosealants.com/#sle.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.06 SCHEDULES

A. See door and window schedules.

END OF SECTION

SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Annealed float glass.
   2. Tempered safety glass.

1.02 REFERENCE STANDARDS

A. {RSTEMP#548}ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes;2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

E. GANA (GM) - GANA Glazing Manual 2008.

F. GANA (SM) - GANA Sealant Manual 2008.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Guardian Industries Corporation.
   2. Trulite Glass and Aluminum Solutions: www.trulite.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass; Drama Dressing Room: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Edges: Bevelled.
   3. Size: As indicated on drawings.

C. Mirror Glass; Weight Room: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Edges: Bevelled.
   3. Size: As indicated on drawings.

2.03 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Glazing Clips: Manufacturer's standard type.

C. Mirror Attachment Accessories: Stainless steel clips.

D. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

E. J-Shape Frame: Aluminum extrusion, dimensions as detailed on drawings.
   1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
   2. Finish: Anodized, clear.
   3. Four-Sided Frame: Mitered joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

3.03 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.

C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.

D. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices 2021.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:
   1. Airline Louvers: www.airlinelouvers.com/#sle.
   2. Airolite Company, LLC: www.airolite.com/#sle.
   3. American Warming and Ventilating: www.awv.com/#sle.
   4. Construction Specialties, Inc; Acoustical Louver: www.c-sgroup.com/#sle.
   5. Industrial Louvers, Inc: www.industriallouvers.com/#sle.
   6. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.

B. Stationary Louvers: Horizontal or Vertical, extruded aluminum construction.
   1. Free Area: 50 percent, minimum.
   2. Pressure Drop: 0.10 inches of water gauge (25 Pa) maximum per square foot (square meter) of free area at velocity of 600 fpm (3.0 m/s), when tested in accordance with AMCA 500-L, test unit size 48 inch by 48 inch (1.22 m by 1.22 m).
   3. Blades: Drainable.

4. Frame: 4 inches deep (100 mm deep), channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
5. Aluminum Thickness: Frame 12 gauge, 0.0808 inch (2.05 mm) minimum; blades 12 gauge, 0.0808 inch (2.05 mm) minimum.
6. Aluminum Finish: Class I natural anodized; finish welded units after fabrication.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.04 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

2.05 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

C. Fasteners and Anchors: Galvanized steel.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

END OF SECTION

DIVISION 9 – FINISHES

09 21 16	GYPSUM BOARD ASSEMBLIES
09 22 16	NON-STRUCTURAL METAL FRAMING
09 30 00	TILING
09 51 00	ACOUSTICAL CEILINGS
09 64 66	WOOD ATHLETIC FLOORING
09 65 00	RESILIENT FLOORING
09 65 66	RESILIENT ATHLETIC FLOORING
09 68 13	TILE CARPETING
09 72 00	WALL COVERINGS
09 84 30	SOUND-ABSORBING WALL PANELS
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Acoustic insulation.

D. Cementitious backing board.

E. Gypsum wallboard.

F. Joint treatment and accessories.

G. Textured finish system.

H. Acoustic (sound-dampening) wall and ceiling board.

1.02 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

F. 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 2018.

G. 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 2020.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

I. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2021.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

M. ASTM E413 - Classification for Rating Sound Insulation 2016.

N. GA-216 - Application and Finishing of Gypsum Panel Products 2016, with Errata.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with ASTM E 119.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum; Firestop Type C: www.gpgypsum.com/#sle.
   4. National Gypsum Company; Fire-shield G: www.nationalgypsum.com/#sle.
   5. PABCO Gypsum: www.pabcogypsum.com/#sle.
   6. USG Corporation: www.usg.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).

C. Impact Resistant Wallboard:
   1. Application: Interior Sports Areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire-resistance-rated Type X, UL or WH listed.
   4. Thickness: 5/8 inch (16 mm).
   5. Edges: Tapered.
   6. Paper-Faced Products:
      a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
      b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
      c. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board: www.nationalgypsum.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Backing Board For Wet Areas:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
   2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
      a. Thickness: 1/2 inch (12.7 mm).
      b. Products:
         1) Custom Building Products; Wonderboard: www.custombuildingproducts.com/#sle.
         2) USG Corporation; DUROCK Cement Board: www.usg.com/#sle.
         3) FinPan, Inc.; Util-A-Crete Concrete Backer Board.
         4) Substitutions: See Section 01 60 00 - Product Requirements.

E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Type: Type X, in locations indicated.
   3. Type X Thickness: 5/8 inch (16 mm).
   4. Edges: Tapered.
   5. Products:
      a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
      b. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, and LC-bead at exposed panel edges.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Chemical hardening type compound.

E. Textured Finish Materials: Latex-based compound; plain.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as approved by Architect for visual effect.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materialsand as indicated.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

C. 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 2020.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. SCAFCO Corporation: www.scafco.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C shaped with knurled or embossed faces.
      a. Thickness: 0.0329 inch, unless otherwise indicated.
      b. Depth: 3 5/8 inch, unless otherwise indicated.
      c. EQ studs are accepted up to 13 ft.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

B. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

C. Fasteners: ASTM C1002 self-piercing tapping screws.

D. Sheet Metal Backing: 0.036 inch (0.9 mm) thick, galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Align and secure top and bottom runners at 24 inches (600 mm) on center.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Align stud web openings horizontally.

G. Secure studs to tracks using crimping method. Do not weld.

H. Fabricate corners using a minimum of three studs.

I. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

J. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

K. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

I. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

E. Ceramic trim.

F. Non-ceramic trim.

1.02 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.

B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.

C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).

D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.

E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.

F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).

G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).

H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).

I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).

L. 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).

M. 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.

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.

P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.

Q. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2021.

R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Ceramic Mosaic Tile:
   1. Size: 2 by 2 inch (51 by 51 mm), nominal.
   2. Surface Finish: Unglazed.
   3. Color(s): Field to be Group II..
   4. Trim Units: Matching bead, cove, and surface bullnose shapes in sizes coordinated with field tile.
   5. Products:
      a. Basis of Design: Dal-Tile Corporation.
      b. American Olean Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Glazed Wall Tile, Type Shower Ceilings:
   1. Size: 6 by 6 inch (152 by 152 mm), nominal.
   2. Edges: Square.
   3. Surface Finish: High gloss.
   4. Color(s): Group IV.
   5. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
   6. Products:
      a. Basis-of-Design: Dal-Tile Corporation.
      b. American Olean Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Quarry Tile(Kitchen): ANSI A137.1 standard grade.
   1. Size: 6 by 6 inch (152 by 152 mm), nominal.
   2. Thickness: 1/2 inch (12.7 mm), nominal.
   3. Edges: Square.
   4. Surface Finish: Non-slip.
   5. Color(s): To be selected by Architect from manufacturer's full range.
   6. Trim Units: Matching bullnose and cove shapes in sizes coordinated with field tile.
   7. Products:
      a. Dal-Tile Corporation; Quetread: www.daltile.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Porcelain Floor Tile:
   1. Size: 12" x 24", nominal.
   2. Thickness: 1/2 inch (12.7 mm).
   3. Edges: Cushioned.
   4. Surface Finish: Matte glazed.
   5. Pattern: As indicated.
   6. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.
   7. Products:
      a. Basis of Design: Daltile Linden Point glazed porcelain - "Grigio LP21".
      b. American Olean Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

F. Porcelain Large Dimension Wall Tile :
   1. Size: 12 by 24 inch.
   2. Thickness: 5/16 inch (8 mm).
   3. Edges: Cushioned.
   4. Surface Finish: Matte glazed.
   5. Pattern: As indicated.
   6. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.
   7. Products:
      a. Basis of Design: Daltile Linden Point glazed porcelain - "Grigio LP21".
      b. American Olean Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

G. Porcelain Large Dimension Wall Tile (Accent Band):
   1. Size: 4" x24" (cut from full 12" x 24" piece at factory or in field).
   2. Thickness: 5/16 inch (8 mm).
   3. Edges: Cushioned.
   4. Surface Finish: Matte glazed.
   5. Pattern: As indicated.
   6. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.
   7. Products:
      a. Basis of Design: Daltile Theoretical Bold, three colors as selected by Architect.
      b. American Olean Corporation.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.

c. Floor to Wall Joints: Cove base.
2. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
a. Open edges of wall tile.
b. Open edges of floor tile.
c. Wall corners, outside and inside.
d. Transition between floor finishes of different heights.
e. Thresholds at door openings.
f. Expansion and control joints, floor and wall.
g. Floor to wall joints.
h. Borders and other trim as indicated on drawings.
2. Manufacturers:
a. Schluter-Systems: www.schluter.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SETTING MATERIALS

A. Manufacturers:
1. Mapei: www.mapei.com
2. Custom Building Products: www.custombuildingproducts.com/#sle.
3. LATICRETE International, Inc: www.laticrete.com/#sle.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
2. Products:
a. Mapei: www.mapei.com.
b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
c. LATICRETE International, Inc; 257 TITANIUM: www.laticrete.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
1. Mapei: www.mapei.com.
2. Custom Building Products: www.custombuildingproducts.com/#sle.
3. LATICRETE International, Inc: www.laticrete.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
3. Color(s): As selected by Architect from manufacturer's full line.

D. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Color(s): As indicated.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Products:

a. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 5/8 inch thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.
1. Products:
a. C-Cure; C-Cure Board 990.
b. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.
c. FinPan, Inc; Util-A-Crete Concrete Backer Board.
d. USG Corporation; DUROCK Cement Board.
e. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.02 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile in grid pattern, unless otherwise indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base, and wall joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.03 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F112, bonded, unless otherwise indicated.

1. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.

B. Cleavage Membrane: Lap edges and ends.

C. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.04 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W211, bonded mortar bed without membrane.

3.05 CLEANING

A. Clean tile and grout surfaces.

3.06 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two full size samples illustrating material and finish of acoustical units.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Full size panels. Quantity equal to 2 percent of total installed.

1.04 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by {\rs\#1} for the fire resistance indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.
   4. Rockfon.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Rockfon, LLC: www.rockfon.com/#sle.
   4. USG Corporation: www.usg.com/ceilings/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.

B. Acoustical Panels, Type 1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 48 inch (610 by 1219 mm).
   3. Thickness: 5/8 inches (16 mm).
   4. Light Reflectance: LR 1 (Over 75%) percent, determined in accordance with ASTM E1264.

5. NRC Range: 0.50 to 0.60, determined in accordance with ASTM E1264.
6. Panel Edge: Square.
7. Color: White.
8. Suspension System: Exposed grid.
9. Products:
    a. Fine Fissured Pattern: CertainTeed "School Board"..
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Acoustical Panels Type 2: Mineral fiber with membrane-faced overlay, with the following characteristics:
1. Classification: ASTM E1264 Type IV.
    a. Pattern: "E" - lightly textured.
2. Size: 24 by 24 inches (610 by 610 mm).
3. Thickness: 5/8 inches (16 mm).
4. Panel Edge: Reveal.
5. Tile Edge: Beveled.
    a. Joint: Tegular.
6. Color: White.
7. Suspension System: Exposed grid.
8. Products:
    a. CertainTeed "School Board".
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Acoustical Panels, Type 3: Mineral fiber with scrubbable finish, with the following characteristics:
1. Application(s): Kitchen.
2. Classification: ASTM E1264 Type IX.
    a. Form: 2, water felted.
    b. Pattern: "G" - smooth.
3. Size: 24 by 48 inch (610 by 1219 mm).
4. Thickness: 5/8 inches (16 mm).
5. Panel Edge: Square.
6. Color: White.
7. Suspension System: Exposed grid.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
1. Materials:
    a. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.

B. Exposed Suspension System: Aluminum grid and cap.
1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch (24 mm) face width.
3. Finish: Baked enamel.
4. Color: White.

C. High-Humidity Finish: Comply with ASTM C635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes in kitchen area.

2.04 ACCESSORIES

A. Support Channels and Hangers: Primed steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
2. At Concealed Grid: Provide exposed L-shaped molding.

D. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Trim Height: 6 inch (152 mm).
2. Finish: Baked enamel.
3. Color: White.

E. Gypsum Board: Fire rated type; 5/8 inch (16 mm) thick, ends and edges square, paper faced.

F. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
1. Products:
a. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

M. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 64 00
WOOD STAGE FLOORING

PART GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Solid masonite sheathing flooring over plywood substrate for the Stage area – painted black finish.

1.03 SUBMITTALS

A. Product data: For each type of product indicated.

B. Shop drawings: show installation details including location and layout of each type of wood flooring and accessory.

C. Samples for initial selection: Manufacturer color charts showing the full range of colors and finishes available for wood flooring.

D. Samples for verification: for each type of wood flooring and accessory, with stain color and finish required, approximate 12-inches (300-mm) long and of same thickness and material indicated for the Work. Include sample sets showing the full range of normal color and texture variations expected.

1.04 QUALITY ASSURANCE

A. Installer qualifications: An experienced installer who has completed wood flooring similar in material, design and extent to that indicated for this Project and whose work has resulted in wood flooring installations with a record of successful in-service performance.

B. Source limitations; obtain each type of material and product from once source with resources to provide materials and products of consistent quality in appearance and physical properties.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver wood flooring materials per manufacturer recommendations.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile and similar wet-work is complete and dry.

C. Store wood flooring materials in a dry, warm, well-ventilated, weather tight location.

D. Move wood flooring into spaces where it will be installed, at least seven days before installation.

1.06 PROJECT CONDITIONS

A. Conditioning: Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75˚ F (18 and 24˚ C) in spaces to receive wood flooring for at least seven days before installation, during installation and for at least seven days after installation. After post-installation period, maintain relative humidity and ambient temperature planned for building occupants.
   1. For unfinished products, open sealed packages to allow wood flooring to acclimatize.
   2. Do not install flooring until it adjusts to the relative humidity of and is at the same temperature as the space where it is to be installed.
   3. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by flooring and finish manufacturers.

1.07 WARRANTY

A. General warranty: Special warranty specified in this article shall not deprive Owner of other rights Owner may have under other provision of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements

of the Contract Documents.

B. Wood flooring warranty: Written warranty, signed by manufacturer agreeing to repair or replace wood flooring that fails in materials or workmanship. Failures include, but are not limited to, buckling, cupping and warping.
   1. Warranty period: Five years from Substantial Completion.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels.
   1. Wood flooring: equal to 1% of amount installed for each type and finish indicated.

PART PRODUCTS

2.01 MASONITE FLOORING

A. Masonite sheathing – Tempered plyron – Tempered hardboard faces with C veneer plywood core as manufactured by Olympic panel products or approved equal.
   1. Masonite
   2. Thickness: 3/4-inch
   3. Face: smooth
   4. Size: 4 ’x 8’ sheets
   5. Eased sheathing edges

2.02 SUBFLOOR SYSTEM

A. Plywood underlayment: one layer APA rated, C-D plugged, exterior glue, tongue and groove, 3/4-inch thick.

2.03 FINISHING MATERIALS

A. Sealer: urethane based pliable coating – as required to stabilize flooring and compatible with black finish coat.

B. Paint: in black color as approved by sealer manufacturer and as follows. Provide test patch in inconspicuous location to verify adhesion and proper cover.
   1. Coronado Rust Scat
   2. Glidden Spread Ultra
   3. Sherwin Williams MetalLatex

2.04 ACCESSORY MATERIALS

A. Fasteners: as recommended by manufacturer, but not less than that recommended in NOFMA’s “Installing Masonite Flooring.”
   1. Fastener materials: Unless otherwise indicated, provide the following:
      a. Stainless steel items: type 304 stainless steel fasteners
      b. Uncoated steel items: plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed.

PART EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions with installer present, for compliance with requirements, installation tolerances and other conditions affecting performance of wood floorings. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: comply with flooring manufacturer written instructions, but not less than recommendations in NOFMA’s “Installing Masonite Flooring,” as applicable to flooring type.

B. Pattern: lay wood flooring in pattern indicated on Drawings or, if not indicated, as directed by Architect.

C. Expansion space: provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4-inch (19-mm), unless otherwise indicated on Drawings.
   1. Unless fully concealed by trim, fill expansion space with flush cork expansion strip.

D. Vapor retarder: where flooring is nailed to sleepers over concrete, install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.

E. Underlayment: install perpendicular to direction of flooring, staggering end joints in adjacent rows.

3.03 FINISHING

A. Apply filler according to manufacturer written instructions.
   1. Fill open-grained wood.
   2. Fill and repair seams and defects.

B. Apply floor sealer according to finish manufacturer written instructions.

C. Apply painted floor finish according to finish manufacturer written instructions. Apply in number of coats recommended by finish manufacturer for application indicated, but not less than three.

3.04 PROTECTION

A. Cover complete installed wood flooring to protect it from damage or deterioration, before and after finishing, during remainder of construction period. Use heavy kraft-paper of other suitable covering. Do not use plastic sheet of film that could cause condensation.
   1. Do not cover site-finished floors with kraft paper, or any other material, until finish reaches full cure, but not less than seven days after applying last coat.

END OF SECTION

SECTION 09 64 66
WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood athletic flooring.

B. Resilient cushioning.

C. Sheet vapor retarder.

D. Floor finishes.

E. Surface finishing and game markings.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete subfloor surface; recessed.

1.03 REFERENCE STANDARDS

A. MFMA (PUR) - Performance and Uniformity Rating Sport Specific Standards current edition.

B. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring, floor finish materials, and resilient cushion.

C. Shop Drawings: Indicate floor joint pattern and termination details.
   1. Indicate provisions for expansion and contraction, wall base, and game insert or socket devices.
   2. Indicate size and type fasteners and anchors.
   3. Indicate location, size, design, and color of game markings.

D. Samples: Submit two samples illustrating floor finish, color, and sheen.

E. Installation Instructions: Indicate standard and special installation procedures.

F. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with MFMA (SPEC).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.

C. Installer Qualifications: Company specializing in installing products specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and store off the floor in a well-ventilated, weather-tight space.

1.07 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 55 degrees F (13 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 50 percent for a period of seven days prior to delivery of materials to installation space, during installation, and after installation.

C. Acclimate wood flooring materials to installation space a minimum of 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Athletic Flooring:

1. Aacer Flooring; AacerFlex: www.aacerflooring.com/#sle.
2. Action Floor Systems; Action Cush I: www.actionfloors.com/#sle.
3. Connor Sports Flooring; Focus: www.connorfloor.com/#sle.
4. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PLYWOOD BASED RESILIENT SYSTEM – BASKETBALL COURTS AND DANCE FLOOR

A. General: Wood strip flooring, MFMA (PUR) compliant for application indicated; system components provided by single manufacturer.

B. Application: Basketball courts and dance floor.

C. System Description:
1. Fixed, cushioned strip subfloor system.

D. Components
1. Species: Northern hard maple, kiln dried; tongue and groove edges, end matched.
2. Grade: Second and better.
3. Cut: Edge grain.
4. Thickness: 25/32 inch (20 mm).
5. Width: 2-1/4 inches (57 mm).

E. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
1. Material: EPDM Rubber or Neoprene
2. Thickness: 9/16 inch (11 mm).

F. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch (12 mm) or 23/32 inch (18 mm) thick. As standard with manufacturer.

G. Vapor Retarder: Polyethylene sheet, 6 mil (0.15 mm) thick; 2 inch (50 mm) wide tape for sealing sheet seams.

H. Fasteners and Anchors: Manufacturer's standard type and size to suit application.

2.03 FINISHES

A. Floor Finishes: Types recommended by flooring manufacturer and complying with MFMA specifications.
1. Sealer: Oil based urethane.
2. Finish Coats: Oil based urethane; high gloss.
3. Game Marking Paint and Stained Areas: Compatible with sealer and finish coats; provide full court painting and staining as per design from Architect and Owner with full color logos and designs with up to five colors. Final drawing and design will be forthcoming after bid.

2.04 ACCESSORIES

A. Ventilating Base: Molded rubber, 4 inch (101 mm) high with a 3 inch (75 mm) toe, pre-molded outside corners; color as selected by Architect.

B. Edge Strip: Angle; mill finish aluminum.

C. Transition Strip: Same species and finish as flooring material; profiles indicated.

D. Game Socket Devices: Cast aluminum type, with anchors.

E. Adhesives: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet (6 mm in 3 m).

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare substrate to receive wood flooring in accordance with manufacturer's and MFMA instructions.

B. Vacuum clean substrate.

3.03 INSTALLATION

A. Place vapor retarder over concrete surface, overlap seams a minimum of 6 inches (150 mm) and seal with tape.

B. Sleepers with Plywood Subfloor:
   1. Place sleepers at 90 degree angle to direction of finished floor; space 12 inches (300 mm) on center. Stagger end joints a minimum of 24 inches (610 mm).
   2. Fasten plywood subfloor over sleepers at 90 degree angle to direction of finished floor. Allow minimum 1/4 inch (6 mm) between plywood subfloor edges.

C. Install solid blocking at doorways, under stacked bleachers, under locations of heavy equipment, and as shown on drawings, in accordance with flooring manufacturer's recommendations.

D. Wood Flooring:
   1. Install in accordance with manufacturer's and MFMA instructions.
   2. Lay flooring parallel to length of main playing area. Blind nail or staple to subfloor.
   3. Install edge strips at unprotected or exposed edges, and where flooring terminates.
   4. Provide 2 inch (24 mm) expansion space at walls and other interruptions.

E. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside corners.

F. Install floor sockets, inserts, and cover plates to a depth sufficient to ensure flush top surface with floor surface.

G. Finishing:
   1. Mask off adjacent surfaces before beginning sanding.
   2. Sand flooring to smooth even finish with no evidence of sander marks. Remove dust by vacuum.
   3. Apply finishes in accordance with floor finish manufacturer's and MFMA instructions.
   4. Apply two sealer coats and two finish coats.
   5. Apply first coat, allow to dry, then buff lightly with recommended pad to remove irregularities. Vacuum clean and wipe with damp, lint-free cloth before applying succeeding coats.
   6. Apply game lines/markers in accordance with layout indicated on drawings.
      a. Solid painting of the court border with school team names, foul lanes and center court circle is required. Cross court lines in a lighter contrasting color and volleyball markings are also as indicated or as required for court layouts indicated. Final court design will be forthcoming after bid.
   7. Apply last coat of finish.

3.04 CLEANING

A. Clean floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on finished floor for 72 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Resilient stair accessories.

D. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

E. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 4 by 4 inch (102 by 102 mm) in size illustrating color and pattern for each resilient flooring product specified.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: Furnish one box for every 50 boxes or fraction thereof, of each type and color.
   3. Extra Wall Base: 10 linear feet (3 linear meters) for every 500 linear feet (150 linear m) of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) but not more than 90 degrees F (32 degrees C) to achieve temperature stability. Maintain temperature during and for 48 hours after installation. Thereafter, maintain conditions above 55 degrees F (13 degrees C) but not more than 95 degrees F (35 degrees C).

1.07 WARRANTY

A. Luxury Vinyl Tile: Manufacturer's limited wear commercial warranty.
   1. Warranty Period: Twenty years from date of Substanial Completion.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile: Surface-decorated, with wear layer.
   1. Manufacturers:
      a. Basis of Design: Shaw Contract - Surface and Strand.
      b. Mohawk.
      c. Patcraft.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, Class III.
   3. Type: B, smooth surface; Finish: UV-cured polyurethane.
   4. Plank Tile Size: 18" x 36".
   5. Total Thickness: 0.100 inch (2.5 mm).
   6. Pattern: Coordinate with the Architect.
   7. Color: To be selected by Architect from manufacturer's full range.
   8. Seamless-Installation Method: Chemically bonded.

2.02 STAIR COVERING

A. Stair Landings, Stair Treads with Integral Risers: Rubber landing tiles, Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company: www.johnsonite.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Nominal Thickness: 0.1875 inch (4.75 mm).
   5. Nosing: Square.
   6. Tread Texture: Raised.
   7. Tread Pattern: Hammered.
   8. Color: To be selected by Architect from manufacturer's full range.

B. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
   1. Nominal Thickness: 0.080 inch (2.0 mm).

2.03 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; top set Style B, Cove.
   1. Manufacturers:
      a. Armstrong Flooring.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Mannington.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Height: 4 inch (100 mm).

3. Thickness: 0.125 inch (3.2 mm).
4. Finish: Satin.
5. Length: Roll.
6. Color: To be selected by Architect from manufacturer's full range.
7. Accessories: Premolded external corners.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Adhesive for Vinyl Flooring: water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

D. Moldings, Transition and Edge Strips: Vinyl.
1. Manufacturers:
a. Burke Flooring; [____]: www.burkeflooring.com/#sle.
b. Johnsonite.
c. Roppe Corporation.
d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
1. Test in accordance with ASTM F710.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate immediately before installation.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install plank tile with a random offset of at least 6 inches (152 mm) from adjacent rows.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 65 66
RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber tile, adhesively installed.

B. Interlocking, loose-laid rubber tile.

1.02 RELATED REQUIREMENTS

A. Section 09 65 00 - Resilient Flooring.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

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, and layout, colors, and widths of game lines and equipment locations.

D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.07 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

A. Manufacturers:
   1. Mondo America.
   2. Tarkett.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rubber Tile Flooring (Type 1 - Weight Room): Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder.
   1. Thickness: Minimum 1 inch.
   2. Size: Nominal 24 inch by 24 inch.
   3. Tensile Strength: Minimum 150 psi (1.0 MPa), per ASTM D412.
   4. Tile Edge/Installation: Interlocking shape, loose-laid installation.
   5. Surface Texture: Smooth.

6. Color: As selected from manufacturer's standard range.
7. Products:
    a. U.S. Rubber Recycling, Inc; Sportfloor Tiles: www.usrubber.com/#sle.
    b. Tarkett; Droptile.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Rubber Tile Flooring (24 inch rubber wall base in weight room): Recycled vulcanized rubber and colored granules.
1. Thickness: Minimum 3/8 inch (10 mm).
2. Tile Edge/Installation: Straight, adhesive installation.
3. Size, Straight Edge Tile: Nominal 24 inches by 24 inches.
4. Surface Texture: Smooth.
5. Color: As selected from manufacturer's standard range.
6. Products:
    a. Basis of Design: Tarkett Replay Square Tiles.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

C. Transitions, Thresholds, and Trim: As recommended by flooring manufactur

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius (1/1000).

C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Rubber Tile Flooring:
1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.

4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.
5. Install loose-laid tile in a staggered pattern, fit interlocking edges tightly.

3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Walk-off carpet tile.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of joints.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Submit two, 12 inch long samples of edge strip, base cap, and stair nosing.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum ten years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Shaw Contract Group.
      a. Unit Price (Collection: Places Series)
   2. Mohawk Group.
      a. Unit Price (Collection: Learn & Live)
   3. Tandus-Centiva.
      a. Unit Price (Collection: Edifice & Chain Reaction)
   4. Patcraft.
      a. Unit Price (Collection: Cube and Color)
   5. Philadelphia Commercial Products.
      a. Unit Price (Collection: Mosaic Mix)
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Note: Subcontractors shall submit bids for carpet based on a standard Unit Price of $22.00 per sq. yd. (Material product only). Installation shall be added to bid and listed as a seperate item on bid form. The School District reserves the right to choose any of the above collections. If the selected collection is accepted, the Owner will accept the cost increase or decrease according to the selected collection due to the Unit price submitted.

2.02 MATERIALS

A. Tile Carpeting, Type Carpet Tile: Tufted, manufactured in one color dye lot.
   1. Yarn System: Multi-level pattern loop
   2. Dye Method: 100% solution dyed.
   3. Soil/Stain Protection: Yes

4. Tile Size: 24 inch by 24 inch, nominal.
5. Total Thickness: 0.230 inch, nominal.
6. Pile Thickness: 0.116 inch.
7. Color: To be selected by Architect.
8. Pattern: To be selected by Architect.
9. Texture Appearance Retention Rating (TARR): Severe
10. Radiant Panel: (ASTM E -648) Class 1
11. Smoke Density: (ASTM E -662) £ 450
12. Static: (AATCC – 134) < 3.0 KV.
13. Dimensional Stability: AACHEN Din 54318 < 0.10%.
14. Gage: 1/12 inch.
15. Stitches: 9.0 per inch.
16. Yarn Size: 18.0-20.0 denier.
17. Pile Weight: 20 oz/sq yd.
18. Density Factor: 6207 kilotex.
19. Light Fastness: (AATCC 16 – E) ³ 4.0 @ 60 AFU's.
20. Primary Backing Material: Synthetic or Polyolefin Composite.

B. Tile Carpeting, Type Walk-Off Mat: Tufted, manufactured in one color dye lot.
1. Product: Steppin Out or comparable manufactured by Shaw Contract Group.
2. Yarn System: Multi-level pattern loop
3. Dye Method: 100% solution dyed.
4. Soil/Stain Protection: Yes
5. Tile Size: 24 inch by 24 inch, nominal.
6. Pile Thickness: 0.157 inch.
7. Color: To be selected by Architect.
8. Pattern: To be selected by Architect.
9. Gage: 1/12 inch.
10. Stitches: 11.0 per inch.
11. Primary Backing Material: Manufacurer's Standard.
12. Secondary Backing Material: Eco Works.

C. All carpets shall be constructed of 100% premium brand nylon, and shall include all specific warranties which are provided by the manufacturer of the carpet fiber. Carpets shall be solution dyed, yarn dyed, or spaced dyed as identified in section 2.2. No other secondary brand nylons will be considered.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Vinyl, color as selected by Architect.

C. Resilient Base: See Section 09 65 00, Resilient Flooring.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

2.04 SPECIAL NOTE

A. Prior to ordering products, verify that curing compounds, etc. used on concrete substrate by others are compatible with primers and carpet adhesive specified in this section.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

3.03 INSTALLATION

A. At the beginning of installation and a minimum of once during the installation and once upon completion of the installation, an inspection shall be made by a representative of the carpet manufacturer to ascertain that the work is being installed according to the manufacturer's published recommendations. Inspector shall be an employee of the manufacturer and not of the contractor, distributor, or manufacturer's agent.

B. Starting installation constitutes acceptance of subfloor conditions.

C. Install carpet tile in accordance with manufacturer's instructions.

D. Blend carpet from different cartons to ensure minimal variation in color match.

E. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

F. Install carpet tile in the following patterns as determined by Architect: ashlar, brick, monolithic, quarter turn, or random.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 72 00
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering and borders.

1.02 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems 2020.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 12" x 12" in size illustrating color, finish, and texture.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
   3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering - Type 1 - Accent Walls in Conference Room and Principal's Office: Fabric-backed vinyl roll stock.
   1. Backing: Woven, osnaburg fabric.
   2. Color: As selected by Architect.
   3. Manufacturers:
      a. Koroseal/RJF International; Basis of Design: Orleans or Interloom: www.koroseal.com/#sle.
      b. MDC Wallcoverings: www.mdcwall.com/#sle.
      c. Wolf-Gordon: www.wolfgordon.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Wall Covering: Type 2 - Wall Carpet for Practice Rooms, complying with the following:
   1. Manufacturers:

a. Basis of Design: Hytex Rib.
b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

E. Termination Trim: Extruded plastic, clear.

F. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

G. Substrate Primer and Sealer: Alkyd enamel type.

H. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

I. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

D. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

E. Butt edges tightly.

F. Overlap adjacent panels as recommended by manufacturer.

G. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09 84 30
SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

1.03 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.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 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 WALL AND CEILING UNITS

A. Manufacturers:
   1. Soelberg Industries.
   2. Armstrong.
   3. TURF.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. General:
   1. Prefinished, factory assembled fabric-covered panels.
   2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Acoustical Panels for Walls: (Type 1 - Painted Tectum Panels - See drawings for locations)
   1. Basis of Design: Tectum Direct-Attach Wall Panels by Armstrong or approved equal.
   2. Surface Texture: Coarse
   3. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   4. Finish: Standard white from manufacturer, painted by painting contractor.
   5. Color: As selected by Architect from Manufacturer's full range.
   6. Size: 48" wide x 96" high and up to 12' long.
   7. Thickness: 1 inch.
   8. Edge Profile: Beveled and square, see drawing details.

9. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423 ; (Mounting; A(0.40); D-20(0.45); C-20(0.80); C-40(0.85) Classified with UL label.
10. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criteria after being painted six times.
11. Light Reflectance (LR) White Panel: ASTM E 1477; (Light Reflectance)
12. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
13. Sustainable: Third party verified EPD (Environmental Product Declaration) and HPD (Health Product Declaration) and Living Product Imperative Certification.
14. USDA Certified Biobased Product, 98%

2.02 FABRICATION

A. 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.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal:

B. Panel Adhesive: Acceptable to acoustical panel manufacturer 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. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

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. Width of joints.

3.03 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 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.

1.02 SUBMITTALS

B. Product Data: For each type of product indicated.

C. Samples: For each finish and for each color and texture required.

D. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.03 QUALITY ASSURANCE

E. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

1.04 EXTRA MATERIALS

F. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) number> of each material and color applied.

PART 2 - PRODUCTS

2.01 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. Colors: As selected by Architect from manufacturer's full range.

2.02 PRIMERS/SEALERS

C. Alkali-Resistant Primer: MPI #3.

D. Bonding Primer (Water Based): MPI #17.

2.03 METAL PRIMERS

E. Alkyd Anticorrosive Metal Primer: MPI #79.

F. Quick-Drying Alkyd Metal Primer: MPI #76.

2.03 EXTERIOR LATEX PAINTS

G. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

H. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

I. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

2.04 EXTERIOR ALKYD PAINTS

J. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

K. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).

2.05 QUICK-DRYING ENAMELS

L. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

M. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

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. Masonry (Clay and CMU): 12 percent.
3. 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 AND APPLICATION

A. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

B. 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.

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.

3.03 EXTERIOR PAINTING SCHEDULE

E. DeVoe is used for basis of bidding, other manufacturers listed are acceptable on or equal basis.

F. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Devoe Coatings.
2. Benjamin Moore and Co. (Moore).
3. PPG Paints (PPG).
4. The Sherwin-Williams Company (S-W).

G. All Structural and Miscellansous Steel Shall Receive:

1. 1st Coat: DeVoe 13101 Metal Primer - if not shop primed.
2. 2nd Coat: DeVoe BAR-OX Interior-Exterior Alkyd Quick Dry Gloss Enamel 581XX
3. 3rd Coat: DeVoe BAR-OX Interior-Exterior Alkyd Quick Dry Gloss Enamel 581XX

H. All Hollow Metal Frames and Doors, Metal Door Grilles, Metal Window Frames in Doors (Factory Primed) Shall Receive:

1. 1st Coat: BAR-OX Alkyd Shop/Field Primer 41839 Gray (touch up only).
2. 2nd Coat: BAR-OX Interior-Exterior Alkyd Quick Dry Gloss Enamel 581XX.
3. 3rd Coat: BAR-OX Interior-Exterior Alkyd Quick Dry Gloss Enamel 581XX.

I. All Galvanized Metal, Exposed Mechanical Units On Roof, Exposed Mechanical Vent Hoods, Sheet Metal Flashing, and Coated Sheet Metal Shall Receive:

1. 1st Coat: MIRROLAC Galvanized Metal Primer 13201.
2. 2nd Coat: WONDER-SHIELD Satin Exterior Acrylic Latex House & Trim Paint 16XX.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Wood.
7. Gypsum board.
8. Ceiling Acoustical Panels.
9. Structural brick Sealer
10. Exposed Structure, Ductwork, Conduit, Etc.

B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

1. Painting includes field-painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, door grilles, door window frames, in-wall table frames, athletic equipment, and primed metal surfaces of mechanical and electrical equipment.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 SUBMITTALS

D. Product Data: For each type of product indicated.

E. Samples: For each finish and for each color and texture required.

F. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.03 QUALITY ASSURANCE

G. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

H. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

3. Final approval of color selections will be based on benchmark samples.
a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

I. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.

J. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

1.04 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.01 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. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Devoe Coatings (Devoe).
2. Benjamin Moore and Co. (Moore).
3. PPG Paints (PPG).
4. The Sherwin-Williams Company (S-W).

C. Colors: As selected by Architect from manufacturer's full range.

2.02 BLOCK FILLERS

D. Interior/Exterior Latex Block Filler: MPI #4.

2.03 PRIMERS/SEALERS

E. Interior Latex Primer/Sealer: MPI #50.

F. Interior Alkyd Primer/Sealer: MPI #45.

2.04 METAL PRIMERS

G. Alkyd Anticorrosive Metal Primer: MPI #79.

H. Quick-Drying Alkyd Metal Primer: MPI #76.

I. Rust-Inhibitive Primer (Water Based): MPI #107.

J. Cementitious Galvanized-Metal Primer: MPI #26.

K. Waterborne Galvanized-Metal Primer: MPI #134.

L. Vinyl Wash Primer: MPI #80.

M. Quick-Drying Primer for Aluminum: MPI #95.

2.05 LATEX PAINTS

N. Interior Latex (Flat): MPI #53 (Gloss Level 1).

O. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).

P. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

Q. Interior Latex (Satin): MPI #43 (Gloss Level 4).

R. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

S. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

T. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).

U. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).

V. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).

W. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).

X. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).

Y. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).

Z. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).

AA. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).

BB. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

CC. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

DD. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

2.06 ALKYD PAINTS

EE. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).

FF. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

GG. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

HH. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).

2.07 QUICK-DRYING ENAMELS

II. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

JJ. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

2.08 TEXTURED COATING

KK. Latex Stucco and Masonry Textured Coating: MPI #42.

1. VOC Content: E Range of E2.

2.09 DRY FOG/FALL COATINGS

LL. Latex Dry Fog/Fall: MPI #118.

MM. Waterborne Dry Fall: MPI #133.

NN. Interior Alkyd Dry Fog/Fall: MPI #55.

2.10 ALUMINUM PAINT

OO. Aluminum Paint: MPI #1.

2.11 FLOOR COATINGS

PP. Interior Concrete Floor Stain: MPI #58.

QQ. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.

RR. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.

SS. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).

TT. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).

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. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. 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 AND APPLICATION

A. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

B. 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.

C. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:.

    a. Switchgear.
    b. Panelboards.
    c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

D. 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.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.03 INTERIOR PAINTING SCHEDULE

E. All Gypsum Board, Acoustical Wall Panels, and Exposed Concrete (Other Than Those Receiving Epoxy Paint) Shall Receive:

1. 1st Coat: WONDER-TONES Interior Vinyl Latex Primer-Sealer 50801.
2. 2nd Coat: REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.
3. 3rd Coat: REGENCY 35XX Satin acrylic.

F. All Concrete Block Walls (Other Than Those Receiving Epoxy Paint) Shall Receive:

1. 1st Coat: BLOXFIL 200 Interior-Exterior Latex Block Filler 52902.
2. 2nd Coat: REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.
3. REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.

G. All Masonry Walls and Tectum Wall Panels with Supergraphics (As Shown On Drawings) Shall Receive:

1. 1st Coat: BLOXFIL 200 Interior-Exterior Latex Block Filler 52902.
2. 2nd Coat: REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.
3. REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.

H. All Hollow Metal Doors and Frames Shall Receive:

1. 1st Coat: BAR-OX Alkyd Shop/Field Primer 41839 Gray
2. REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.
3. REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.

I. All Miscellaneous Steel or Metal, Exposed Structure, Including Electrical Panel Boards Covers, Wall Mounted Registers or Grilles, Exposed Conduit/Piping, Exposed Ductwork, and Exposed T-Grid Shall Receive:

1. 1st Coat: BAR-OX Alkyd Shop/Field Primer 41839 Gray
2. RENENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.
3. REGENCY Satin Lustre Interior Acrylic Latex Enamel 35XX.

J. All Gypsum Board Shall Receive:

1. 1st Coat: WONDER-PRIME Primer-Sealer Interior Acrylic Latex Vapor Barrier 51701.
2. 2nd Coat: TRU-GLAZE-WB Waterborne Epoxy Gloss Coating 129XX/12902.
3. TRU-GLAZE-WB Waterborne Epoxy Gloss Coating 129XX/12902.

K. Concrete Block Walls (Epoxy Paint) Shall Receive:

1. 1st Coat: TRU-GLAZE-4 Epoxy Semi-Gloss Coating 124XX/12602.
2. 2nd Coat: TRU-GLAZE-4 Epoxy Gloss Coating 124XX/12402.
3. 3rd Coat: TRU-GLAZE-4 Epoxy Gloss Coating 124XX/12402.

L. Exposed Painted Concrete Floors Shall Receive: (Concrete Must Age 90 Days Prior to Application)

1. 1st Coat: GRANITEX Interior Modified Epoxy Clear Concrete Floor Sealer 45700.
2. 2nd Coat: GRANITEX Interior Modified Epoxy Clear Concrete Floor Sealer 45700.
3. Install paint color mixture to sealer if requested by Architect.

M. Exposed Interior Masonry (Brick) Walls, Concrete Walls, and Concrete Benches Shall Receive:

1. 2 Coats come E-7000 (clear) added with S/G cure.

N. All Interior Hardwood Cabinets, Fir Plywood Shelving, and Standing and Running Trim Shall Receive:

1. 1st Coat: WoodWorks Alkyd Interior Stain 96XX.
2. 2nd Coat: WoodWorks Clear Polyurethane Finish 6600.
3. 3rd Coat: WoodWorks Clear Polyurethane Finish 6600.
4. 4th Coat: WoodWorks Clear Polyurethane Finish 6700.

3.04 MISCELLANEOUS MATERIALS

O. 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.

P. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

3.05 INSTALLATION

Q. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

R. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

1. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve

curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
c. Clean concrete floors to be sealed with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

2. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).

a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

S. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer and only within recommended limits.

T. Tint undercoats to match the Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Provide sufficient differences in shade of undercoats to distinguish each separate coat.

U. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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 concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, 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 from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

V. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations.

Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.06 APPLICATION

W. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

X. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Provide finish coats that are compatible with primers used.
3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
4. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

Y. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

Z. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.

1. Brushes: Use brushes best suited for the material applied.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

AA. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

BB. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

CC. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

3.07 CLEANING

DD. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

EE. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.08 PROTECTION

FF. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

GG. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

DIVISION 10 – SPECIALTIES

10 11 00	VISUAL DISPLAY UNITS
10 14 00	SIGNAGE
10 21 13.17	PHENOLIC TOILET COMPARTMENTS
10 28 00	TOILET AND BATH ACCESSORIES
10 44 00	FIRE PROTECTION SPECIALTIES
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10 75 00	FLAGPOLES

SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Glass markerboards.

C. Tackboards.

1.02 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI A208.1 - American National Standard for Particleboard 2016.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

D. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

F. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, tackboard surface covering, and trim.

E. Test Reports: Show compliance to specified surface burning characteristics requirements.

F. Maintenance Data: Include data on regular cleaning and stain removal.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site.

1.06 PROJECT CONDITIONS

A. 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ADP Lemco, Inc: www.adplemco.com/#sle.

B. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.

C. MooreCo, Inc: www.moorecoinc.com/#sle.

D. Polyvision Corporation: www.polyvision.com/#sle.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards:
   1. Color: White.
   2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
   3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum , with concealed fasteners.
   7. Frame Profile: As indicated on drawings.
   8. Frame Finish: Anodized, natural.
   9. Accessories: Provide chalk tray, map rail, and flag holder.

B. Magnetic Glass Markerboards: Back-coated glass, laminated to steel.
   1. Glass: Laminated, low iron, 1/4 inch thick (6 mm thick), with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board or projection surface.
   2. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
   3. Size: As indicated on drawings.
   4. Frame: No frame, with concealed fasteners.
   5. Mounting: Concealed Z clips.
   6. Accessories: Provide magnetic marker tray, magnetic marker holder, magnetic eraser, and magnets.

C. Tackboards: Fabric laminated to fiberboard.
   1. Fabric: Vinyl coated fabric.
   2. Backing: Fiberboard, 3/8 inch (9.5 mm) thick, laminated to tack surface.
   3. Size: As indicated on drawings.
   4. Frame: Same type and finish as for markerboard.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Float Glass: Provide float-glass-based glazing unless otherwise indicated.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

D. Vinyl Coated Fabric: ASTM F793 Category VI.

E. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

F. Foil Backing: Aluminum foil sheet, 0.005 inch thick (0.13 mm thick).

G. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall (; 25 mm wide overall) , full width of frame.

B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.

C. Flag Holders: Cast aluminum bored to receive 1 inch (25 mm) diameter flag staff, bracketed to fit top rail of board.

D. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.

E. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.02 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Plaque.

1.02 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 - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Allotech.
   2. Howard Industries.
   3. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
   4. Novalloy Plus.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Plaques:
   1. Allotech.
   2. ASI Sign Systems.
   3. Interpretive Graphics Signs & Systems.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSIBILITY COMPLIANCE

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Concealed screws.
   4. Restroom and Auxiliary Door Signs: Provide a sign for every doorway except classroom and office doors. Classroom and office signs will be provided by Owner.
      a. Sign Type: Flat signs with engraved panel media as specified.
      b. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
      c. Character Height: 1 inch (25 mm).
      d. Sign Size: 10" x 6" , unless otherwise indicated.
      e. Office Doors: Identify with the room names and numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
      f. Conference and Meeting Rooms: Identify with the room names and numbers indicated on drawings.
      g. Service Rooms: Identify with the room names and numbers indicated on drawings.
      h. Rest Rooms: Identify with pictograms, the names, "MENS" "WOMENS" "RESTROOM" room numbers indicated on the drawings, and braille.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: GT Roffe or selected by Architect.
   2. Character Case: Upper case only.
   3. Background Color: As selected by Architect.
   4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/8 inch (3 mm).

2.05 PLAQUES

A. Metal Plaques:
   1. Metal: Aluminum sheet, flat, etched.
   2. Metal Thickness: 3/8 inch, minimum.
   3. Size: 24 inch by 18 inch.
   4. Surface Finish: Brushed, satin.
   5. Product: NOVALLOY+PLUS METAL MICRO-IMAGED or approved equal.
   6. Graphic Layout: Will be provided by Architect and approved by Owner before production. Verify names with Architect during shop drawing process.
      a. Name of Building
      b. Name of School District
      c. Year Completed
      d. Name of Superintendent and School Board Members
      e. School District Administration Staff
      f. Architectural Firm

g. Construction Manag
h. School Logo
i. School District Logo
j. School Districts Construction Person

7. Mounting: As indicated on drawings.

2.06 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Exposed Screws: Chrome plated.

C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 21 13.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal screens.

1.02 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch (150 by 150 mm) in size illustrating panel finish, color, and sheen.

E. Submit complete working sample to the Architect 7 days prior to bidding showing manufacturer's ability to meet the requirements of this specification. Sample to include the following:
   1. Hardware (complete)
   2. Pilaster 3/4" thick
   3. Door 3/4" thick
   4. Divider panels 1/2" thickness
   5. Continuous Piano Hinge
   6. Continuous mounting bracket

1.04 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.

B. Coordination: Coordinate delivery with other work to avoid delay.

1.05 WARRANTY

A. Furnish 12 year warranty for panels, doors and stiles against breakage, corrosion, delamination, and defects in factory workmanship.

B. Furnish 12 year warranty against breakage, defects in material and workmanship for all hardware and mounting brackets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. Bradley Corporation.
   2. Bobrick.
   3. Metpar Corp.
   4. Partition Systems International of South Carolina.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
   1. Color: Single color as selected by Architect.

B. Doors:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: 24 inch (610 mm).
   3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 58 inch (1473 mm).

C. Panels:
   1. Thickness: 1/2 inch (13 mm).
   2. Height: 58 inch (1473 mm).

D. Pilasters:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: As required to fit space; minimum 3 inch (76 mm).

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.

C. Wall and Pilaster Brackets: Polished stainless steel; continuous type.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

E. Hardware: Polished stainless steel:
   1. Continuous piano hinge, gravity type, adjustable for door close positioning.
   2. Door Latch: Slide type with exterior emergency access feature.
   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.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

3.02 INSTALLATION

A. Install partitions secure, rigid, straight, plumb, and level in accordance with manufacturer's instructions and recommended anchoring devices.

B. Maintain 3/8 inch to 1/2 inch (9 mm 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 partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Electric hand dryers.

D. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com/#sle.
   2. American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation: www.bradleycorp.com/#sle.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Bright polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
   1. Size: 24" wide x 36" tall.
   2. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.

B. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.

b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin on ends and slip-resistant texture in grip area.
d. Length and Configuration: Straight 36" long, straight 42" long.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1-1/4 inch (32 mm) outside diameter, 0.05 inch (1.3 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.

B. Shower Curtain:
1. Material: Nylon reinforced vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
2. Size: 36 by 72 inches (914 by 1830 mm), hemmed edges.
3. Grommets: Corrosion-resistant metal; pierced through top hem on 6 inch (150 mm) centers.
4. Color: As selected from manufacturer's standard colors.

C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, L-shaped, right hand seat.
1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected by Architect.
2. Size: ADA Standards compliant.
3. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
4. Products:
a. Basis of Design Product: (Bradley #956).
b. American Specialities, Inc.
c. Substitutions: Section 01 60 00 - Product Requirements.

D. Shower Towel Hooks: Two-prong stainless steel no. 4 satin polished finish, complete with brackets for mounting.

2.06 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
1. Operation: Automatic, sensor-operated on and off.
2. Mounting: Surface mounted.
3. Cover: Stainless steel with brushed finish.
a. Tamper-resistant screw attachment of cover to mounting plate.
4. Electric Hand Dryer Products:
a. World Dryer Corporation; VERDEdri Q-973: www.worlddryer.com/#sle.
b. Substitutions: Section 01 60 00 - Product Requirements.

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
1. Drying rod: Stainless steel, 1/4 inch (6 mm) diameter.
2. Hooks: Three, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
3. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
4. Length: 36 inches (900 mm).

2.08 ACCESSORIES SCHEDULE

A. **Single Restrooms**: Home Girls 246, Home Boys 245, Family 131, Family 203, Officials 142, Restrooms: 126 C, 118, 117, 130B, 101A, 100F, 106E
1. 1 - 24" x 36" Mirror
2. 1 - 36" Grab Bar
3. 1 - 42" Grab Bar
4. 1 Electric Hand Dryer

B. **Men's Restrooms**: 131A, 104B, 203A

Women's Restrooms: 131B, 104A, 203B

1. 3 - 24" x 36" Mirror
2. 1 - 36" Grab Bar
3. 1 - 42" Grab Bar
4. 2 - Electric Hand Dryer

C. **Restrooms**: 119B, 142B, 141B

1. 2 - 24" x 36" Mirror
2. 1 - 36" Grab Bar
3. 1 - 42" Grab Bar
4. 2 - Electric Hand Dryer

D. **Restroom 122B**

1. 3 - 24" x 36" Mirror
2. 1 - 36" Grab Bar
3. 1 - 42" Grab Bar
4. 3 - Electric Hand Dryer

E. **Shower Rooms: Boys Home 142B, Visitor Girls 141B**

1. 1 - Folding ADA Shower Seat
2. 1 - 32" x 32" Grab Bar
3. 3 - Shower Towel Hook
4. 3 - Shower Curtain
5. 3 - Shower Curtain Rod

F. **Single Showers:** Restroom 130B and Officials Restroom 142

1. 1 - Folding ADA Shower Seat
2. 1 - 32" x 32" Grab Bar
3. 1 - Shower Towel Hook
4. 1 - Shower Curtain
5. 1- Shower Curtain Rod

G. **Custodial**: 133, 126B, 121C, 130C, 106B, 212, 200F

1. 1 - Broom and Mop Rack

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

1. Grab Bars: As indicated on drawings.
2. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide current edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

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

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher ratings and classifications.
   1. Fire-Protection Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.
   2. Show location of knockouts for hose valves.

C. Samples: For each exposed cabinet finish.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.06 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business: www.ansul.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Potter-Roemer: www.potterroemer.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Ansul, a Tyco Business: www.ansul.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Potter-Roemer: www.potterroemer.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 5 pound (2.27 kg).
   3. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K type.
   2. Size: 2.5 gallon.
   3. Temperature range: Minus 20 degrees F (Minus 29 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rated Cabinet Construction: One-hour fire rated.
   1. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.

B. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

D. Door Lock: Cylinder lock, keyed alike to other cabinets.

E. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Fabrication: Weld, fill, and grind components smooth.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings as shown on plans.

C. Secure rigidly in place.
D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 50 10
KNOX BOX

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Knox-Box

B. Related Section: The following sections contain requirements that relate to this Section.
   1. Section 04200 “Unit Masonry” for coordination with masonry construction.
   2. Section 08710 “Door Hardware” for dual key cylinder.
   3. Section 28312 “Fire Alarm System” for tie-in with building alarm system.

1.02 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Section.

B. Product data including manufacturer’s technical data, installation instructions and general recommendations for product specified. Include data substantiating that materials and performance comply with requirements.

1.03 QUALITY ASSURANCE

A. Coordinate work of this Section with adjoining work for proper sequencing of installation to ensure protection of materials and finishes against damage.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Knox-Box: Shall be Knox-Box 3200 Series as manufactured by Knox Company.
   1. Or approved equal prior to bidding.

2.02 KNOX-BOX

A. Knox-Box: Recessed mount with hinged door, UL listed tamper switches, ¼” plate steel housing, ½” thick steel door with interior gasket seal and stainless steel door hinge. Box and lock UL listed. Lock has 1/8” thick stainless steel dust cover with tamper seal mounting capability.
   1. Exterior Dimensions: Recessed mount – 7”H x 7”W x 3-1/4”D
   2. Lock: Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
   3. Finish: Know-Coat propriety finishing process.
   4. Color: As selected by Architect.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Comply in strict accordance with manufacturer’s written installation instructions. Coordinate installation with work of other trades and locate accurately.
   1. Recessed mounting kit (RMK) to be used for installation as recommended by manufacturer.
   2. Location and mounting of Knox-Box to be determined by Architect and local Fire Marshal.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

C. 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 2021a.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples showing color and finish of metal locker material.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. ASI Storage Solutions: www.asi-storage.com/#sle.
   2. List Industries, Inc: www.listindustries.com/#sle.
   3. Lyon Workspace Products: www.lyonworkspace.com/#sle.
   4. Penco Products, Inc: www.pencoproducts.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Corridor Lockers: Metal lockers, recessed mounted.
   1. Width: 12 inches (305 mm).
   2. Depth: 15 inches (381 mm).
   3. Height: 72 inches (1830 mm).
   4. Configuration: Two tier.
   5. Fittings: Size and configuration as indicated on drawings.
      a. Hooks: Three single prong.
   6. Ventilation: Louvers at top and bottom of door panel.
   7. Locking: Built-in combination locks, key-controlled, three number dialing. Capable of at least five combination changes made automatically with a control key,
      a. Bolt operation: manually locking deadbolt or automatically locking spring bolt, as standard by manufacturer.
   8. Provide sloped top.
   9. Color: To be selected from manufacturer's full range by Architect.

B. Team Lockers: Metal lockers, wall mounted for base indicated on drawings.
   1. Width: 18 inches (457 mm).
   2. Depth: 18 inches (457 mm).
   3. Height: 72 inches (1830 mm).
   4. Configuration: Single tier.

5. Fittings: Size and configuration as indicated on drawings.
    a. Upper shelf.
    b. Hooks: Three single prong.
6. Ventilation: Perforated side panels and diamond perforated doors.
7. Locking: Built-in combination locks, key-controlled, three number dialing. Capable of at least five combination changes made automatically with a control key,
    a. Bolt operation: manually locking deadbolt or automatically locking spring bolt, as standard by manufacturer.
8. Provide sloped top.
9. Color: To be selected from manufacturer's full range by Architect.

C. P.E. and Shop Lockers: Metal lockers, wall mounted for base indicated on drawings.
1. Width: 15 inch (381 mm).
2. Depth: 15 inches (381 mm).
3. Height: 72 inches (1830 mm).
4. Configuration: Triple Tier.
5. Fittings: Size and configuration as indicated on drawings.
    a. Upper shelf.
    b. Hooks: Three single prong.
6. Ventilation: Perforated side panels and diamond perforated doors.
7. Locking: Built-in combination locks, key-controlled, three number dialing. Capable of at least five combination changes made automatically with a control key,
    a. Bolt operation: manually locking deadbolt or automatically locking spring bolt, as standard by manufacturer.
8. Provide sloped top.
9. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.

B. Locker Case Construction:
1. Heavy-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
    a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
        1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
        2) Body and Shelves:
            (a) Corrider: 24 gauge, 0.0239 inch (0.61 mm)
            (b) Team, P.E., and Shop: 16 gauge, 0.0598 inch (1.52 mm)
        3) Backs:
            (a) Corrider: 24 gauge, 0.0239 inch (0.61 mm)
            (b) Team, P.E., and Shop: 18 gauge.
    b. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
        1) Door Frame: 16 gauge, 0.0598 inch (1.52 mm), minimum.
    c. Where ends or sides are exposed, provide flush panel closures.
    d. Provide filler strips where indicated, securely attached to lockers.

C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
1. Door Thickness: 14 gage, 0.0747 inch (1.90 mm), minimum.
2. Form recess for operating handle and locking device.

D. Latches and Door Handles: Manufacturer's standard.

E. Hinges: Continuous piano hinge with powder coat finish to match locker color.

F. Sloped Top: 24 gauge, with closed ends.

G. Coat Hooks: Stainless steel or zinc-plated steel.

H. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/8 inch (9 mm) high of block font style with ADA designation, in contrasting color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10 75 00
FLAGPOLES (ALTERNATE #1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

A. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.

B. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Samples: Submit two samples of each finished metal for flagpoles and accessories, illustrating pole material, color, and finish.

E. Operation Data: Provide operating data for the controller.

1.05 QUALITY ASSURANCE

A. Manufacturing Standards: Provide one flagpole as a complete unit produced by a single manufacturer, including fittings, accessories, bases, and anchorage devices.

B. Design Criteria: Provide flagpole and installation constructed to withstand a 90 mph ((145 km/h)) wind velocity minimum when flying flag of appropriate size. Use heavy pipe sizes if required for flagpole type and height shown.

C. Pole Construction: Construct pole and ship to site in one piece if possible. If more than one piece is necessary, provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arrangement for weather-tight, hairline field joints.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole: www.americanflagpole.com/#sle.
   2. Concord Industries, Inc: www.concordindustries.com/#sle.
   3. Colonial Flag.
   4. Pole-Tech Co, Inc: www.poletech.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001
   1. Material: Aluminum.
   2. Design: Cone tapered.
   3. Mounting: Ground mounted type.
   4. Nominal Wall Thickness: 0.064 inch minimum.

5. Nominal Height: (1) 35 ft. measured from top of base.
6. Halyard: Interior type .

B. Performance Requirements:
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 90 miles/hr (145 km/hr) wind speed, in accordance with NAAMM FP 1001.

2.03 POLE MATERIALS

A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Stainless steel, 6 inch (150 mm) diameter.
1. American Beacon- Internal Revolving-winch by American Flagpole or approved equal. 96570-0045, 120V., Silver, 6 Watt L.E.D. Finial Ball/ Flagpole lighting system for each flagpole shown on drawings.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, two per halyard.

D. Halyard: 5/16 inch (8 mm) diameter nylon, braided, with steel or bronze core.

2.05 OPERATORS

A. Hand Crank: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

2.06 FINISHING

A. Aluminum: **Black Anodized.**

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

3.03 INSTALLATION

A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.

B. Electrically ground flagpole installation.

C. Fill foundation tube sleeve with concrete specified in Section 03 30 00.

3.04 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

DIVISION 11 - EQUIPMENT

11 40 00	FOOD SERVICE EQUIPMENT
11 62 10	STAGE RIGGING SYSTEMS
11 66 23	GYMNASIUM EQUIPMENT
11 68 33	ATHLETIC FIELD EQUIPMENT (ALTERNATE #1)

SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 – GENERAL

1.01 Conditions:
All the applicable requirements of Division 0 and Division 1 apply to the work of this section.

1.02 This specification and the accompany drawings must be considered together; any work called for in one or on the other, together with such work as can reasonable be considered a part of the installation and necessary to complete same shall be included.

1.03 Scope

A. Work included: It is the intention of these specifications to designate an inclusive job, complete, and ready to use, except plumbing, heating and electrical connections which shall be made by other contractors. All equipment shall be set in place, leveled, and after utility connections have been made, ready for use.

B. Uniformity of Construction: All specially built equipment shall be made by one manufacturer, and shall be uniform throughout as to method and type of construction used. All equipment shall carry a nameplate identifying the manufacturer.

C. Bid Performance: All bidders must show evidence of their ability to perform the contract and must be regular furnishers and fabricators of such equipment.

D. Specifications, Substitutions: The successful contractor will be bound to furnish equipment in strict accordance with the specifications, including specific manufacturer, model number, size, utilities requirements, capacities, etc., as well as options and accessories.

Manufacturers requesting to be approved as an equal substitute are to submit their request and literature in writing to the Architect for consideration at least 7 days prior to the bid date. Manufacturers will be considered approved only after being stated so in addendum Form. No substitutes shall be accepted after the bid date.

E. Equipment Protection: All equipment shall be received at the building fully protected. It will be the responsibility of the Kitchen Contractor to protect the equipment until completely installed.

F. Building Codes, Regulations, National Sanitation Foundation Standards: All kitchen equipment shall be manufactured and installed in compliance with

all city, state and Federal regulations and code requirements, and in accordance with the latest revised standard of the National Sanitation Foundation Testing Laboratory, Ann Arbor, Michigan, and shall bear their seal of approval.

G. Field Dimensions: The Contractor shall be required to take all field measurements and be responsible therefor. It shall also be the duty of this contractor to coordinate the location of chases and passageways for supply lines in the building. It is recommended that where time does not permit the use of finished field dimensions in fabrication of this equipment, that measurements be determined by General Contractor & Architect and then given to the Kitchen Contractor in Writing.

H. Refrigeration Units: All refrigeration units, hereinafter specified, are to be completely installed by the Food Service Equipment Contractor except for final electric, water (if water connections are specified) and drain units, the Food Service Equipment Contractor shall furnish necessary charge of refrigerant, start and adjust equipment and service same for a period of one year final acceptance by the Owner.

I. Existing Equipment: The KEC shall remove, store and re-install owners existing Equipment and make ready for use, which is to include replacement of minor parts such as Knobs, Gaskets, Faucets, Drain Assemblies, etc… and verify all existing equipment meets current codes. Items which may not be to current codes shall be modified by KEC as required for acceptance of current Health, Fire and Building Codes.

1.04 Related Work in Other Sections:

A. Plumbing: Plumbing connections to equipment will be provided under another section of the specifications including shutoff valves, piping and sink traps necessary to connect up after equipment is installed in place. The Food Service Equipment Contractor shall furnish all necessary faucets and sink drains. The steam and gas connection of equipment shall be provided in another section of the specifications, which will include all final connections to the equipment with the shutoff valves and the supply and return.

B. Electrical: The electrical contractor will furnish disconnect switches and do all wiring to motor starters, motors, automatic controls, protective devices, etc. The Food Service Equipment Contractor shall supply, for each motor driven appliance, for electrically heated units, a suitable control switch or starter of proper type in accordance with Underwriters Code. Loose controls or switches furnished with brand name equipment are to be completely installed by Electrical Contractor.

All electrical equipment shall be correct for the type of electrical current available.

C. Modifications for existing building walls, floors, roof etc.

1.05 Supervision and Instruction:

A. Supervision: The Food Service Equipment Contractor shall visit the job site to check mechanical rough-ins prior to the pouring of the floor slabs and advise the General Contractor of any discrepancy. Cost to relocate or add utility lines due to the failure of the Food Service Equipment Contractor to verify their proper location prior to the pouring of the floor slabs will be assumed by said Food Service Contractor. Food Service Equipment Contractor shall remove all debris accumulated during the delivery and installation of his equipment immediately upon completion of said installation. He will approve a representative, when necessary, to correlate final hook-up related contractors, so as not to impede job progress. After final hook-up, he shall lubricate, start up and check all equipment and turn over to the Owner, for acceptance, in first class condition, all items in his contract.
The Food Service Equipment Contractor shall provide a capable representative or Representative to demonstrate the proper use of the equipment, at the times Selected by the Owner. The Owner is to give said Food Service Equipment Contractor a minimum of seven-calendar days prior to this demonstration date. Contractor a minimum of seven-calendar days prior to this demonstration date.

B. Final Adjustment and Instructions to Owner:

1. When directed by the Architect at completion of this work, proved a competent service representative to be present when installation is put into operation.

2. Lubricate, clean with soap and water and put into proper operation all equipment and instruct the Owner’s employees in the proper use and maintenance of all items in this contract, and set up a maintenance schedule to be followed thereafter.

3. Prepare a letter documenting the fact that instructional work has been accomplished, obtain signature of the Owner thereon, and submit to the Architect before final acceptance of the installation will be considered.

4. Furnish four bound sets of specification sheets of all standard manufactured items complete with service manuals and parts lists, to the Architect, along with shop drawings showing the plan and all mechanical and electrical hookups as installed.

1.06 Guarantee:

The Food Service Equipment Contractor shall fully guarantee all work and material for a period of one year from the date the equipment is put into operation and accepted by the Owner.
Guarantee and condition of service on items of brand name manufacture, as established by the manufacturer, shall apply where extending beyond the guarantee and services set forth in this specification.

PART 2 – PRODUCTS AND EXECUTION

2.01 Stainless Steel: All Stainless Steel shall be of the gauge specified (U.S.Standard) 18-8 composition which is generally known as Type 302 or Type 304 and shall have a Number finish, as manufactured within the continental limits of the United States. All sheets will have a genuine mill finish of not less than 180 grit on one side with not less than 100 grit on the backside. All stainless steel sheets which bear the manufacturer's trademark designation of type and heat number. All stainless shall have the following content:

Chromium – 18 per cent minimum
Nickel – 8 per cent minimum
Carbon – 2 tenths per cent maximum

Straight chrome iron or copper bearing straight chrome iron will not be acceptable. All stainless steel sheets shall be stretcher leveled. All sheets shall be free of buckles, warps and surface imperfections. Bidders are particularly cautioned that a hard ground finish will not be acceptable.

2.02 Galvanized Iron: Wherever specified, iron shall be of an approved grade of wither low Carbon steel or copper bearing steel to one of the following brands:

American Rolling Mills (ARMCO)
Republic Steel, etc.

All sheets are to be commercial quality, stretcher level, bonderized and rerolled to ensure a smooth surface. Where galvanized iron is specified, it shall be copper bearing sheets used in the largest sizes with as few joints as possible. All welded joints are to be sandblasted and refinished with rust proof galvanized zinc compound. All galvanized iron is to be finished with a prime coat plus two finished coats of gray hammerloid enamel.

2.03 Welding: All welding shall be done in a thorough manner will all welds of the same composition as sheets or parts welded. Welds shall have full penetration the entire length of the joint and shall be flat without buckles, voids or imperfections. Welds shall be strong, ductile, with excess metal ground off and joints finished smooth to match the adjoining surface. Welds shall be of the same color as the adjacent metal, ground and polished on the exposed side and ground on the backside. Welds to be

free of imperfections such as pits, runs, splatter, cracks, etc. All joints in the tops of fixtures, drainboards, shelving, sinks, etc. shall not be welded with the carbon arc welding or by any method permitting carbon pickup. Soldering riveting, bolting or spot welding of seams in tops is not acceptable for full arc welding. It is the intention of this specification that all welded joints shall be homogenous with the sheet metal itself.

2.04 Grinding, Polishing and Finishing: All exposed welded joints, including field joints, shall be suitable ground flush with the adjoining material and neatly finished to harmonize with same. Wherever material has been depressed or sunken in by the welded operation, such depressions shall be suitable hammered and peened flushed with the adjoining surfaces and, if necessary, again ground to eliminate low spots. All ground surfaces shall then be polished or buffed to match adjoining surfaces, consistent with good workmanship. Care shall be exercised in all grinding operations to avoid excessive heating of the metal and metal discoloration. In all cases the grain of rough grinding shall be removed by successive finer polishing operations. The texture of the final polishing operation shall be uniform and smooth, consistent with reasonable care and good workmanship. The general finish of all metal shall be of a high grade. Wherever break bends occur they shall be free of open texture of open texture or orange peel appearance: and where such break work does not mar the uniformity of the appearance of the material, all such marks shall be removed by suitable grinding, polishing and finishing. Wherever sheared edges occur, they shall be free of burrs, projections and fins to obviate all danger of cutting and laceration when the hand is drawn over such sheared edges. Where miters of bullnose corners occur, they shall be neatly finished with the under edges of the material neatly ground to a uniform condition and in no case shall overlapping material be acceptable. It is the intention of the specification to cover equipment of a quality finish consistent with the highest grade of manufacturing practice in the industry.

3.0 SUBMITTALS:

A. Submit the following in accordance with the General Provisions of the Contract and General and Supplementary Condition and Division 1 Specifications Sections.

1. Product date and installation instructions for each item: Include roughing-in dimensions, service connection requirements, performances, materials, manufacturers' model numbers, furnished accessories, power/fuel requirements, water/drainage requirements, and other similar information.

2. SHOP DRAWINGS:

   A. Including dimensioned rough-in drawings showing mechanical and electrical requirements.
   B. Submit dimensioned fabrication drawings for custom fabricated equipment. Include plans, elevations, and sections, showing materials and gauges used.

3. Samples of exposed finishes for custom fabricated equipment, 8-inch squares of materials

and 12-inch lengths of running members and trim.

4. Maintenance date and parts lists for each item of food service equipment.

B. Maintenance Manual: Include all of the above listed data, plus wiring diagrams in a bound maintenance manual, in accordance with the requirements of Division 1.

PART 1 ITEMIZED LIST OF KITCHEN EQUIPMENT – MAIN KITCHEN

ITEM #1 HAND SINK with SOAP AND TOWEL DISPENSER

QUANTITY:	6 Each
MANUFACTURER:	Advance
MODEL #:	7-PS-87

ITEM #2 DRY STORAGE SHELVING

QUANTITY:	1 Lot
MANUFACTURER:	Cambro
MODEL #:	(4) Each #CPU246084V5PKG
ACCESSORIES:	(13) Each #CPA246084V5PKG
	(2) Each #CPU245484V5PKG
	(1) Each #CPA244884V5PKG
	(1) Each #CPA245484V5PKG
	(20) Each #CPD524h6480

ITEM #3 DUNNAGE RACK

QUANTITY:	6 Each
MANUFACTURER:	Cambro
MODEL #:	DRS480480

ITEM #4 CAN RACK

QUANTITY:	1 Each
MANUFACTURER:	LAKESIDE
MODEL #:	478

ITEM #5 WALK-IN COOLER/FREEZER BOX

QUANTITY:	1 Lot
MANUFACTURER:	IMPERIAL-BROWN
MODEL #:	#21-IB-67946
DESCRIPTION:	Walk-in Cooler/Freezer Combination box with 4” thick, All urethane insulation construction. Provide (2) standard 42” x 78” entrance doors. Complete with brushed chrome hardware, interior safety release, digital thermometer and magnetic gasket seal. Freezer door to have heated door perimeter and threshold with heated air vent. Wall partition and door location as shown on plans. Size and shape as per

plans.

UTILITIES: 120/60/1

ACCESSORIES: Provide (2) Each 1414-VP 14” x 14” view port window in walk-in Entry door.
(2) Each 3 Hinge floating door hinges per door
(1) Each Matching closure panels from top of walk-in box to Ceiling (10’0” high maximum to ceiling height)
(2) Each DB-Lock provide additional dead bolt lock on entry Door, lock mechanism shall be located on interior of door with key access on exterior, safety release shall be provided.
(1) Each Galv-ext provide standard 26 Gauge embossed Galvalume exterior finish.
(1) Each Galv-int provide standard 26 Gauge embossed white interior finish.
(2) Each kick plate, 1/8” stainless steel tread plate, 3’6” x 4’0”
(6) Each additional LED vapor proof light fixtures for field mounting.
(Mounting of Fixtures by Electrical Contractor)
(2) Each TM100 Alarm systems
(1) Each White painted interior
(1) Each White painted exterior (where shows only)
(1) Each Vinyl screed 1-1/2” high
Screeds to mounting to finished building floor
(Insulated building floor by General Contractor)
(1) Each 16 Gauge Stainless Steel Diamond Tread 48” High Wainscot at exposed exterior wall

ITEM #6A COOLER REFRIGERATION SYSTEM

QUANTITY: 1 Each

MANUFACTURER: IMPERIAL-BROWN

MODEL #: RF0130E45EA-NT

UTILITIES: 208/60/3 1 HP
120/60/1 (EVAPORATOR)

DESCRIPTION: Air cooled pre-assembled remote system. Supplied (high side Assembly). Evaporator (low side assembly). All refrigeration Lines are supplied and installed by Installing Contractor. Standard installed components include: Thermostatic Expansion valve, solenoid valve, temperature control, sight Glass, drier, pressure control and master controller.

ACCESSORIES: (1) Each 5-year Compressor Warranty
(1) Each RL6A094ADARE medium temperature evaporator with low silhouette coil for 35 degree temperature system.

(1) Each Outdoor refrigerator accessories for outdoor use consisting of crankcase heater, low ambient controls and weatherproof housing.

ITEM #6B FREEZER REFRIGERATION SYSTEM

QUANTITY:	(1) Each
MANUFACTURER:	IMPERIAL-BROWN
MODEL #:	RF0400L4SEB-NT
DESCRIPTION:	Air cooled pre-assembled remote system. Discus compressor Supplied with a holding charge of dry nitrogen. Consists of Condensing unit (high side assembly), Evaporator (low side Assembly). All refrigeration lines are supplied and installed by Installing Contractor. Standard installation components include: Thermostatic expansion valve, Solenoid valve, temperature Control, sight glass drier, pressure control and master Controller. Defrost time clock shipped loose for field mounting by Electrical Contractor.
UTILITIES:	208/60/3 3 HP 208/60/1 (Evaporator)
ACCESSORIES:	(1) Each 5-Year Compressor Warranty (1) Each RL6E121DDARE low temperature evaporator with low Silhouette coil for 0 degree to 10 degree temperature system (1) Each Outdoor refrigerator accessories for outdoor use consisting of crankcase heater, low ambient controls and weatherproof housing.

ITEM #7 POT WASHER

QUANTITY:	(1) Each
MANUFACTURER:	JACKSON
MODEL #:	RACKSTAR 44
ACCESSORIES:	(1) Each PRV valve (3) Each Sheet Pan Racks (3) Each Flat Racks (6) Each Dish Racks (1) Each Table Limit Switch (1) Each Water Hammer Arrestor Kit (1) Each Drain water tempering valve (1) 70 degree rise built in booster heater (1) Electric heat (1) Single point elec. connection (1) Higher than std chamber

ITEM #8 CLEAN DISHTABLE

QUANTITY:	(1) Each
MANUFACTURER:	CUSTOM FABRICATED
MODEL #:	CUSTOM
DESCRIPTION:	Dishtable constructed of 14 Gauge Stainless Steel with 10" High backsplash at wall and 3" rolled rim front and end. Table is mounted on 1-5/8", 16 Gauge stainless steel legs with adjustable feet and stainless steel gussets. Provide with reinforcing as specified. Size and shape as per plans.
ACCESSORIES:	(1) Each 16 Gauge Stainless Steel undershelf with front and sides turned down 1-1/2", rear turned up 2". Mount table limit switch at the end of table.

ITEM #9 SOILED DISHTABLE

QUANTITY:	(1) Each
MANUFACTURER:	CUSTOM FABRICATED
MODEL #:	CUSTOM
DESCRIPTION:	Dishtable constructed of 14 Gauge Stainless Steel top with 10" high backsplash at walls and 3" rolled rim front edge. Table is mounted on 1-5/8", 16 Gauge Stainless Steel legs with adjustable feet and stainless steel gussets. Provide reinforcing as specified. "V" edge front as pass thru. Size and shape as per plan.
ACCESSORIES:	(1) Each 16 Gauge Stainless Steel undershelf with front and sides turned down 1-1/2", rear turned up 2". (1) Each 6" scrap hole with rubber scrap block (1) Each 20 x 20 x 10 Deep Pre-Rinse Sink with removable rack slide and provisions for garbage disposer (1) Each T & S Brass #B-0133BCC Pre-Rinse unit.

ITEM #10 CONDENSATE HOOD

QUANTITY:	(1) Each
MANUFACTURER:	AVTEC
MODEL #:	NCH-72-48
ACCESSORIES:	Provide 18 Gauge Stainless Steel trim and closure to ceiling and Walls

ITEM #11 STAINLESS STEEL WALL SHELF

QUANTITY:	(1) Each
MANUFACTURER:	CUSTOM FABRICATED
MODEL #:	CUSTOM
DESCRIPTION:	Custom Fabricated Wall Shelf with wall mounting brackets at 32” on center maximum. Size per plans and specifications. Mounting height 60” A.F.F.

ITEM #12 GARBAGE DISPOSER

QUANTITY:	(3) Each
MANUFACTURER:	IN-SINK-ERATOR
MODEL #:	(2) SS-100-7-CC101 (1) SS-100-18B-CC101

ITEM #13 60 QT MIXER

QUANTITY:	(1) Each
MANUFACTURER:	GLOBE
MODEL #:	SP62P
DESCRIPTION:	Provide with standard accessories
ACCESSORIES:	(1) 9” Vegetable Slicer attachment with Grater and Shredder Plates (1) Bowl Truck

Item #14 20 QUART MIXER

QUANTITY:	(1) Each
MANUFACTURER:	GLOBE
MODEL #:	SP20
DESCRIPTION:	Provide with standard accessories

ITEM #15 20 QUART MIXER STAND

QUANTITY:	(1) Each
MANUFACTURER:	ADVANCE
MODEL #:	MT-SS-300
ACCESSORIES:	Provide with TA-25 Caster Set

ITEM #16 THREE COMPARTMENT SINK

QUANTITY:	(1) Each

MANUFACTURER: CUSTOM FABRICATED
MODEL #: CUSTOM
DESCRIPTION: Three Compartment Pot and Pan Sink constructed of 14 Gauge Type 304 stainless steel with (3) 24" x 28" x 14" deep sinks with Lever waste with overflow. Provide undershelf under Drainboard on right end and left flush front. Mount disposer Cone into drainboard as shown and provide disposer switch Bracket welded into underside of drainboard. "Z" clip to wall at 48" centers max. Sink front to be fully welded one piece.
ACCESSORIES: (2) Each T & S Brass #B-290 Faucet
(1) Each T & S Brass #B-0133B-CC Pre-Rinse unit

ITEM #17 STAINLESS STEEL WALL SHELF

QUANTITY: (1) Lot
MANUFACTURER: ADVANCE
MODEL #: (1) Each WS-14-48
(1) Each WS-14-108

ITEM #18 HOSE REEL

QUANTITY: (3) Each
MANUFACTURER: T & S BRASS
MODEL #: B-1444-CV
ACCESSORIES 1 EACH #B-2339LR Control cabinet for unit at can wash

ITEM #19 EXHAUST HOOD

QUANTITY: (2) Each
MANUFACTURER: AVTEC
MODEL #: VDD-PBB
ACCESSORIES: Provide with matching trim and closure to ceiling, thermal Exhaust interlock, divided island filler

ITEM #20 HOOD FIRE PROTECTION SYSTEM

QUANTITY: (1) Lot
MANUFACTURER: ANSUL
MODEL # R-102
DESCRIPTION: Complete system with stainless steel enclosure, a double pole, double throw micro switch for shut-off of any electrical appliances (contactor, shunt trip breakers, fans auto dials, etc., and wiring to this device by Electrical

Contractor), all exposed piping is chrome sleeved, includes all plans and permits, fees and testing (if required by State Fire Marshal) and up to 2" mechanical gas solenoid valve (gas solenoid valve to be installed by Plumbing Contractor). Complete system to be installed by factory authorized service Tech and certified to meet with UL300. NFPA96 and 17A and the insurance services office.

ITEM #21 UTILITY DISTRIBUTION SYSTEM

QUANTITY: (1) Lot
MANUFACTURER: AVTEC
MODEL #: MIDG-A
DESCRIPTION: Island style utility distribution system with main breaker panel Board, sized to accommodate all electrical equipment as shown Including a shunt trip breaker with an auxiliary contact. Furnish breaker status lights. Ventilator light switch with (2) GFCI duplex receptacles (one in each end of riser). Gas supply with solenoid valve (s). (two for each looped systems) to be pre-piped and wired in at factory to a reset switch on the end riser. Each gas service location for appliance shall have a quarter turn ball valve shut-off, quick disconnect fittings and a stainless steel braided poly coated flexible gas hose ready for connections to appliance by Plumbing Contractor. Hot and cold water supply with each service location of appliance shall have quarter turn ball valve shut off, quick disconnect fittings and a stainless steel braided poly coated flexible hose ready for connection to appliance by Plumbing Contractor. Furnish restraining cables for all mobile appliances as required by code. Utility distribution system shall be constructed in coordination With exhaust ventilator to ensure a single unit appearance at The jobsite. Provide all trim and closure panels as required to fully enclose the UDS/Hood to each other and the building. All appropriate trim/closure panels are to be snug fitted, secured and sealed with Department of Environment resources compliant silicone sealant (color to match). Standard features to include: UL listed assembly, stainless steel construction with removable access panels, panel board and receptacles, emergency shut down devices for gas and electric, temperature and pressure gauges on service manifold, shut-off valves at incoming service connections and individual branch connections, full length bumper strips, duplex switch, GFEP and fuel shut off devices in accordance with NFPA96. Provide with

		cord and plug units, gas and water flex hoses for all items as shown. Overall size as per plans.
	UTILITIES:	120-208/60/3 Natural Gas

ITEM #22 UTILITY CART

QUANTITY:	(4) Each
MANUFACTURER:	LAKESIDE
MODEL #:	459

ITEM #23 STEAMER

QUANTITY:	(1) Each
MANUFACTURER:	GROEN
MODEL #:	HY-6G
ACCESSORIES:	(1) Each #153119 Water Treatment System (1) Set #146301 Flanged Feet

ITEM #24 TILT SKILLET

QUANTITY:	(1) Each
MANUFACTURER:	GROEN
MODEL #:	BPP-40GA
ACCESSORIES:	Motor driven Pan Lift, #Z040602 - Double Pantry Faucet Pour lip Strainer and Steam Pan insert (1) Set #147150 Flanged Feet

ITEM #25 RANGE

QUANTITY:	(1) Each
MANUFACTURER:	SOUTHBEND
MODEL #:	4601DD-3GR
ACCESSORIES:	Provide extra Oven Rack for each oven. Thermostatically Control griddle, 5” casters (3) with brakes,Flame failure,Spark Ignition

ITEM #26 DOUBLE CONVECTION OVEN

QUANTITY:	(2) Each
MANUFACTURER:	BLODGETT
MODEL #:	DFG200-ES-DBL-SSID
ACCESSORIES:	Gas Manifold, Drip Tray, 5” Caster set (2) with brakes

ITEM #27 SPARE NUMBER

ITEM #28 PROOFING/HOLDING CABINET

QUANTITY:	(1) Each
MANUFACTURER:	WINSTON
MODEL #:	HL4522-S
ACCESSORIES:	Windows in Both Doors, Perimeter Bumper

ITEM #29 COMBI OVEN

QUANTITY:	(1) Each
MANUFACTURER:	RATIONAL
MODEL #:	ICP-6 FULL NG
ACCESSORIES:	(1) Each #60.31.087 Stand
	(1) Each Water Filter System
	(12) Each Fry Baskets
	(1) Each Temperature Probe
	Left Hand Door Swing
	(1) Combi Touch Control
	(5) Each Grid Shelves
	(1) Each #56.01.535 Tabs
	(1) Each #56.00.562 Tabs
	(1) Each Certified Installation
	(1) Each Installation Kit

ITEM #30 SPARE NUMBER

ITEM #31 SPARE NUMBER

ITEM #32 ICE MACHINE

QUANTITY:	(1) Each
MANUFACTURER:	SCOTSMAN
MODEL #:	CO530SA-1
ACCESSORIES:	(1) Each #B-530S - Ice Storage Bin
	(1) Each SSM1-P Water Filter System

ITEM #33 LOCKERS

QUANTITY:	(6) Each
MANUFACTURER:	KELMAX

MODEL #: EL13/15

ITEM #34 BAKER'S TABLE

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: BST-307R
ACCESSORIES: OTS-12-84R

ITEM #35 INGREDIENT BIN

QUANTITY: (3) Each
MANUFACTURER: PIPER
MODEL #: 47-150

ITEM #36 DOUGH DIVIDER

QUANTITY: (1) Each
MANUFACTURER: DUTCHESS
MODEL #: BMIH-36
ACCESSORIES: (1) Each #B4-436-0072 Portable Stand

ITEM #37 WORKTABLE

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: KSS-305
ACCESSORIES: (2) Each #SHD-2020 Drawer

ITEM #38 MICROWAVE

QUANTITY: (1) Each
MANUFACTURER: PANASONIC
MODEL #: NE-12523
ACCESSORIES: (1) Each Advance #MS-24-24 Microwave Shelf

ITEM #39 OVERSHELF

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: WS-12-84

ITEM #40 SLICER

QUANTITY:	(1) Each
MANUFACTURER:	GLOBE
MODEL #:	S13A-07
ACCESSORIES	Advance #MT-MS-300 STAND-34" HT

ITEM #41 WORKTABLE

QUANTITY:	(1) Each
MANUFACTURER:	ADVANCE
MODEL #:	KSS-305
ACCESSORIES:	(2) Each #SHD-2020 Drawer 14" High Custom Backsplash

ITEM #42 OVERSHELF

QUANTITY:	(1) Each
MANUFACTURER:	ADVANCE
MODEL #:	WS-12-96

ITEM #43 PREP SINK

QUANTITY:	(1) Each
MANUFACTURER:	ADVANCE
MODEL #:	VKS-308
ACCESSORIES:	(1) Each #TA-11C2 Double Sink welded into top as shown on plan (2) Each Lever Drains (1) Each #SHD-2020 Drawer (1) Each T&S Brass #B-0133B Pre-Rinse Unit with B-0155 Add-on Faucet, mount wall bracket to attach to Backsplash 14" High Custom Backsplash

ITEM #44 SPARE NUMBER

ITEM #45 Pass-Thru Refrigerator

QUANTITY:	(2) Each
MANUFACTURER:	TRUE
MODEL #:	STA1RPT-1S-1S
ACCESSORIES:	Hinge doors as per plans

KIT #3 at top section
KIT #4 at bottom section

ITEM #46 PASS THRU WARMING CABINET

QUANTITY:	(2) Each
MANUFACTURER:	TRUE
MODEL #:	STA1HPT-1S-1S
ACCESSORIES:	Hinge doors as per plans
	KIT #3 at top section
	KIT #4 at bottom section

ITEM #47 WORKTABLE

QUANTITY:	(1) Each
MANUFACTURER:	ADVANCE
MODEL #:	SS-306
ACCESSORIES:	(2) Each #SHD-2020 Drawer

ITEM #48 COLD SERVING COUNTER

QUANTITY:	(2) Each
MANUFACTURER:	VOLLRATH
MODEL #:	C13251_1
ACCESSORIES:	

ITEM #49 SERVING COUNTER

QUANTITY:	(2) Each
MANUFACTURER:	VOLLRATH
MODEL #:	CUSTOM C13251_2
ACCESSORIES:	

ITEM #50 MILK COOLER

QUANTITY:	(1) Each
MANUFACTURER:	TRAULSEN
MODEL #:	RMC49D6

ITEM #51 TRAY & SILVER CART

QUANTITY:	(2) Each
MANUFACTURER:	PIPER
MODEL #:	715-1-A10

ACCESSORIES: (2) Each Napkin Dispenser per cart
(10) Each Stainless Steel Silverware Cylinders per cart

ITEM #52 FOOD BAR

QUANTITY: (1) Each
MANUFACTURER: CAMBRO
MODEL #: VBRU6
ACCESSORIES: (2) Each Tray Slides
(1) Each Sneeze Guard
(1) Each End Table
Verify color with Architect

ITEM #53 PAN RACK

QUANTITY: (8) Each
MANUFACTURER: METRO
MODEL #: RD78NA33
ACCESSORIES: Provide with floor lock and corner bumpers

ITEM #54 COOLER/FREEZER SHELVING

QUANTITY: (1) Lot
MANUFACTURER: CAMBRO
MODEL #: (2) Each #CPU243672V4480
(2) Each #CPU244272V4480
(1) Each #CPU244872V4480
(1) Each #CPU245472V4480
(2) Each #CPU246072V4480
(8) Each #CPA244272V4480
(1) Each #CPA246072V4480
(4) Each #CPDS24H6480
INSTALLATION NOTES: Seismically fasten to walls and floor

ITEM #55 DUNNAGE RACK

QUANTITY: (2) Each
MANUFACTURER: CAMBRO
MODEL #: DRS480480

ITEM #56 CAN WASH

QUANTITY: (1) Each

MANUFACTURER: IMC/TEDDY
MODEL #: DL-2

ITEM #57 SPARE NUMBER

ITEM #58 FLOOR TROUGH

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: FFTG-2436

ITEM #59 SNEEZE GUARD

QUANTITY: (2) Each
MANUFACTURER: BSI
MODEL #: XG3500-4-108
ACCESSORIES: Uprights to penetrate thru top and mount to undershelf of Serving Counter

ITEM #60 CHEMICAL SHELVING

QUANTITY: (1) Each
MANUFACTURER: METRO
MODEL #: SEC55LK3

ITEM #61 MOP SINK

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: 9-OP-28
ACCESSORIES: (1) Each #K240 Service Faucet
(1) Each #K246 Utility Shelf

ITEM #62 POS STAND

QUANTITY: (1) Each
MANUFACTURER: LAKESIDE
MODEL #: 641
ACCESSORIES: Provide with Stainless Steel Exterior Finish

ITEM #63 CLOTHES WASHER

QUANTITY: (1) Each

MANUFACTURER: WHIRLPOOL
MODEL #: WTW4850HW
ACCESSORIES: Water Hose Set

ITEM #64 CLOTHES DRYER

QUANTITY: (1) Each
MANUFACTURER: WHIRLPOOL
MODEL #: WED4850HW
ACCESSORIES: Vent Hose, Cord & Plug

ITEM #65 AIR CURTAIN

QUANTITY: (1) Each
MANUFACTURER: MARS
MODEL #: HV248-1VA-SS
ACCESSORIES: Surface Mount Magnetic Reed Switch

ITEM #66 SPARE NUMBER

ITEM #67 SPARE NUMBER

ITEM #68 FOOD PROCESSOR

QUANTITY: (1) Each
MANUFACTURER: HOBART
MODEL #: FP-150-1B
ACCESSORIES: 6-Plate Pack

ITEM #69 WORK TABLE

QUANTITY: (4) Each
MANUFACTURER: ADVANCE
MODEL #: SS-306
ACCESSORIES: 2 TA62 elec. Outlet and TA-62E upgrade
(2) Each #SHD-2020 Drawers Each Table

ITEM #70 POT RACK

QUANTITY: (2) Each
MANUFACTURER: ADVANCE

MODEL #: SCT-72

ITEM #71 DRYING RACK

QUANTITY: (1) Each
MANUFACTURER: CAMBRO
MODEL #: CPMU244875PDPKG

ITEM #72 SODA DISPENSER
PROVIDED BY OWNER

ITEM #73 REFRIGERATOR
PROVIDED BY OWNER

ITEM #74 HAND SINK

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: 7-PS-87

ITEM #75 WORK TABLE

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: KSS305
ACCESSORIES: (2) Each #SHD-2020 Drawer

ITEM #76 POPCORN MACHINE

QUANTITY: (1) Each
MANUFACTURER: STAR
MODEL #: 865

ITEM #77 NACHO CABINET

QUANTITY: (1) Each
MANUFACTURER: STAR
MODEL #: 12NCPW

ITEM #78 NACHO CHEESE WARMER

QUANTITY: (1) Each

MANUFACTURER: STAR
MODEL #: 11WLA-HS

ITEM #79 MICROWAVE

QUANTITY: (1) Each
MANUFACTURER: PANASONIC
MODEL #: NE12523

ITEM #80 3-COMPARTMENT SINK

QUANTITY: (1) Each
MANUFACTURER: ADVANCE
MODEL #: FC-3-1818-18RL
ACCESSORIES: T&S BRASS #B-0133-01-CR
PRE-RINSE WITH ADD-ON FAUCET

ITEM #81 WALL SHELF

QUANTITY: (2) Each
MANUFACTURER: ADVANCE
MODEL #: WS-12-36

ITEM #82 ICE MACHINE WITH BIN

QUANTITY: (1) Each
MANUFACTURER: SCOTSMAN
MODEL #: NS0422A-1
ACCESSORIES: (1) Each #SSM1-P Water Filter

ITEM #83 CONCESSIONS COUNTER

QUANTITY: (1) Each
MANUFACTURER: CUSTOM
MODEL #: Size and shape as shown on plan. Top of 14 Gauge 304 #4 finish stainless steel. At wall intersections provide 6”H x 2” backsplash returned to wall on a 45-degree angle. All other edges to be marine type and turned down 1-1/2”. Counter to be mounted on 12 Gauge 1-5/8” diameter stainless steel legs with Gussets. Undershelf to be full length 16 Gauge3 304 #4 stainless steel turned up 1-1/2” at rear and turned down 1-1/2” at sides and front. Extend top through pass-thru opening 12”. At each opening provide and install stainless steel wrap with a

2” return. Provide (4) Each 20 x 20 Roller bearing Drawer Assembly with stainless steel. Removable pan and lock.

END OF SECTION 114000 FOOD EQUIPMENT

SECTION 11 62 10
STAGE RIGGING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Intent: This specification covers the fabrication, furnishing, delivery, and installation of the stage rigging system, stage curtains and tracks. The form of contract, general conditions, and the project drawings are considered to be parts of these specifications.

B. Complete System: The Rigging Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated. Any errors, omissions or ambiguities do not relieve the Contractor of this responsibility, but shall be brought to the attention of the Architect for clarification.

C. Work Included: The work of this section shall include, but not necessarily be limited to the following:
   1. Furnish and install 20 single purchase counterweight linesets.
   2. Furnish and install 5 electrically operated counterweight linesets.
   3. Furnish and install curtain tracks.
   4. Furnish and install stage curtains.
   5. Furnish and install curtain tracks in drama room.
   6. Furnish and install stage curtains in drama room.

D. Related Work: Related work which is not included in this section:
   1. Gridiron, head and loft block beams, and all other structural steel and miscellaneous metals not specifically called out as part of this section.
   2. Galleries, ladders and catwalks.
   3. Stage flooring.
   4. Stage lighting.
   5. Electrical connections, conduit, boxes and wiring of any type.
   6. All power and control wire, containment, terminations, testing are provided by Division 26 and are not a part of this section.

1.02 GENERAL REQUIREMENTS

A. Field Conditions: All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date

B. Safety: The systems shall conform to all applicable code requirements and shall be in conformance with industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the users to arrange and operate a safe assembly and working environment for audience and user personnel.

C. Insurance: In the absence of more stringent requirements, the Rigging Contractor shall maintain injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for Contractor's employees.

1.03 CONTRACTOR QUALIFICATIONS

A. Requirements: The Rigging Contractor shall be an approved rigging manufacturer or an authorized representative or dealer of an approved manufacturer. The contractor shall have

been installing stage rigging systems for a period of five years or more, and shall have completed at least ten installations of this type and scope.

B. The Rigging Contractor shall employ an Entertainment Technician Certification Program (ETCP) Certified Theatre Rigger. The Certified Rigger shall be the project manager or site foreman, and be responsible for the overall project including the layout, inspection, and training. No exception to this requirement.

C. Approved Rigging Contractors: The Theatrical Rigging Contractor shall be one of the following accepted firms:

J.R. Clancy, Inc.
7041 Interstate Island Road
Syracuse, New York 13209

Phone: 18008361885, 3154513440
Fax: 3154511766
E-mail: rigging@jrclancy.com

Oasis Stage Werks
249 Rio Grande
Salt Lake City Utah 84101

Phone: 801-363-0364
Fax: 801-575-7121

D. Requirements for Approval: Other contractors seeking acceptance must submit the following information at least 2 weeks prior to the bid opening date. Approval of contractors will be by addenda. Failure to submit any of the required information will automatically disqualify the contractor from consideration of approval.
   1. A listing of five equivalent installations including:
      a. Name, address and telephone number of Owner;
      b. Name, address and telephone number of architect;
      c. Scope of work.
   2. A brief written description of the contractor's operation including facilities, financial capabilities, and experience of key personnel.
   3. A statement from a bonding company agreeing to provide the required bonds in the amount required for the project.
   4. A copy of the ETCP Certified Theatre Rigger's certification credentials.

1.04 SUBMITTALS

A. Bill of Materials: Bidders shall supply a complete bill of materials with their bids, identifying equipment and quantities being offered.

B. Drawings: Submit component and installation drawings and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. They shall be approved by the Architect before beginning any fabrication, installation, or erection. Such approval does not relieve the Rigging Contractor of the responsibility of providing equipment in accordance with the specifications.

C. Catalog Cuts: In lieu of drawings, the Contractor may submit catalog cuts for standard equipment items. These must contain full information on dimensions, construction, applications, etc. to permit proper evaluation. In addition, they must be properly identified as to their intended use. Any options or variations must be clearly noted.

D. For each type of stage curtain indicated; include color charts showing the full range of colors, textures, and patterns available.

E. Product Certificates: For each type of fabric, signed by product manufacturer.

1. Fabric: Give name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.

F. Schedule: Prior to the commencement of the installation work, the Rigging Contractor shall submit an outline of the proposed schedule and requirements for approval.

1.05 INSTRUCTION:

A. Upon completion of the work, the Rigging Contractor shall submit 3 copies of a comprehensive Operating and Maintenance Manual including asbuilt shop drawings, equipment descriptions, and parts lists. The Rigging Contractor shall go through the manual and provide a safety and instruction class with personnel designated by the owner to demonstrate and explain the operation and maintenance of the systems. The instruction session may be recorded, and a copy of the recording provided to the Owner's representative.

B. Signage with basic operating instructions and warnings shall be posted in the area where the equipment will be operated. Signage shall be in conformance with ANSI-Z535.

1.06 WARRANTY

A. The Rigging Contractor shall provide a written guarantee against defects in materials or workmanship for three years starting from the date of acceptance of equipment by the Owner's representative. The three-year warranty is contingent on inspection of the equipment and training on its use being provided annually by a manufacturer authorized technician. It is the responsibility of the end user to make arrangements with the manufacturer for the annual inspection and training. Failure to obtain the inspection and training annually will void the three-year warranty. The guarantee shall not cover equipment that has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper maintenance, or used not in a manner intended. Any required maintenance or replacement shall be provided by the Rigging Contractor within thirty days of notification by the Owner except for safety related items, which shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period the Rigging Contractor agrees to furnish repair and maintenance service, at the Owner's expense, within thirty days of request for such service.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Due to the highly specialized nature of theatrical rigging equipment, and the safety requirements of the equipment, the rigging products provided for this work shall be the products of a single rigging manufacturer for consistency and ease of integration. Accessory items such as wire rope, fittings, curtain tracks, and the like may be from other specialty manufacturers.

A. The rigging manufacturer must have the following programs in place. Approval to bid does not release the manufacturer from meeting these requirements:
   1. The manufacturer must have a product testing program, including determination of recommended working loads for products based on destructive testing by an independent laboratory and review by an independent licensed engineer.
   2. The manufacturer of the stage equipment must have a quality management system registered to the ISO 9001:2000 standard.
   3. The manufacturer must carry primary product and general liability insurance of $2,000,000 each, with excess liability coverage of $10,000,000 and a Contractors Professional Liability policy with $2,000,000 coverage.

B. Rigging equipment shall be built by the following approved manufacturers:

J.R. Clancy, Inc 7041 Interstate Island Road Syracuse, New York 13209	Phone: 18008361885, 3154513440 Fax: 3154511766 E-mail: rigging@jrclancy.com
H&H Specialties 2203 Edwards Avenue South El Monte, CA 91733	Phone 800-221-9995 Fax: 626-575-3004

C. Requirements for Approval: Other equipment manufacturers seeking approval must submit the following information at least 2 weeks prior to the bid opening date. Approval of manufacturers will be by addenda. Failure to submit any of the required information will automatically disqualify the manufacturers from consideration of approval.

1. Evidence that the manufacturer has been in business for a minimum of ten years manufacturing stage equipment.
2. A listing of 10 equivalent installations including:
   Name, address and telephone number of Owner;
   Name, address and telephone number of architect;
   Scope of work.
3. A brief written description of the manufacturer's operation including facilities, financial capabilities, and experience of key personnel.
4. Written, third party evidence showing that the manufacturer has the testing, quality management and insurance programs required in paragraph B in place.

2.02 GENERAL

A. Standards:

1. Materials shall conform to the following ASTM and ANSI standard specifications:

A-36	Specification for structural steel
A47	Specification for malleable iron casting
A48	Specification for gray iron casting
A120	Specification for black and hotdipped zinccoated (galvanized) steel pipe for ordinary use
B18.2.1&2	Specification for square and hex bolts and nuts
ANSI E1.4-1	- Manual Counterweight Rigging Systems

2. In order to establish minimum standards of safety, the following factors shall be used:

Cables and fittings	8:1 Safety Factor
Cable bending ratio	Sheave tread diameter shall be 30 times cable diameter
Tread Pressures -	500 lbs. for cast iron 900 lbs. for Nylatron 1000 lbs. for steel
Maximum fleet angle	11/2 degrees
Steel	1/5 of yield
Bearings	Two times required load at full speed for 2000 hours
Bolts	Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
Motors	1.0 Service Factor
Gearboxes	1.25 Mechanical Strength Service Factor

B Materials: All materials used in this project shall be new, unused and of the latest design. Refurbished and obsolete materials are not permitted.

C. Sheaves:
1. Sheaves shall be of the following materials, as specified:
   a. ASTM A-48 Class 30 grey iron castings
   b. Nylatron or Polyamide Nylon (PA6-G)
2. Groove depths shall be sufficient to encompass fully the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
3. Sheaves shall be supported by bearings and a machined steel shaft, which shall be keyed to one side plate to prevent rotation. Proper adjustment of the bearing shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without rubbing its side plates when rotated.

D. Fabrication:
1. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall be no burrs or sharp edges to cause a hazard nor shall there be any sharp corners accessible to personnel.
2. All moving parts shall have specified tolerances. Sheaves shall run plumb and true and shall not scrape housings.
3. All equipment shall be built and installed to facilitate future maintenance and replacement.

E. Finishes:
1. Paint shall be the manufacturer's standard finish and color except as noted.
2. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted.

F. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. This is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

2.03 COUNTERWEIGHT LINE SETS

A. 12" Head Block:
1. The sheave shall be filled nylon with a 12" outer diameter. The sheave shall be equipped with a 1" diameter shaft and two tapered roller bearings.
2. Base angles shall be a minimum 2" x 1.5" x 1/4" angle with the short leg turned in.
3. Side plates shall be a minimum of 10-gauge *(3.57mm)* steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength.
4. Auxiliary base angles shall be a minimum 2" x 1-1/2" x 1/4" angle with the short leg turned in. Angles shall be supplied with punched holes and 1/2" bolts, flat washers and lock nuts.
5. The block and associated mounting hardware shall have a recommended working load of at least 2,500 lbs. *(1,1334kg)*.
6. Head blocks shall be grooved for eight 1/4" lift lines and one 3/4" hand line.

B. Loft Block:
1. The sheave shall have an 8-1/2" outside diameter, and shall be filled nylon. The sheave shall be equipped with a 17 mm diameter machined steel shaft and two sealed, precision ball bearings.
2. Base angles shall be a minimum 11/4" x 11/4" x 3/16" angle punched with a universal hole pattern for easy installation.

3. Side plates shall be a minimum of 12-gauge steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles. There shall be a minimum of seven bolts with spacers between the side plates, four of which prevent cables from escaping the sheave grooves.
4. The block and associated mounting hardware shall have a recommended working load of at least 750 lbs, and shall be designed for use in either upright or underhung usage.
5. Loft blocks shall be grooved for one 1/4” lift line.

C. Idler assemblies:
1. Loft block idlers shall be provided to carry the weight of the cables and prevent rubbing against adjacent block side plates. They shall not be installed to carry line loads or to act as deflector or mule blocks.
2. Idler assemblies shall consist of one or two 3-1/2*" (88.9mm)* diameter, 3-line filled ABS idler pulleys mounted on the side of the loft block housing.
3. The sheaves shall have 1/4” *(6.4mm)* cable grooves and two sealed, precision ball bearings and shall ride on a 1/4” *(6.4mm)* shaft inserted through the block housing.
4. A 1/8” *(3.2mm)* diameter bail shall mount in the housing and captivate the cables in the grooves.
5. All nuts shall be of the nylon insert self-locking type.

D. 10” Tension Floor Block:
1. The cast iron sheave shall have a 10” outside diameter, and shall be an ASTM A48 Class 30 grey iron casting, with a machined groove for a 3/4” rope.
2. The sheave shall be equipped with a 17 mm diameter machined steel shaft and two sealed, precision ball bearings.
3. Side plates shall be a minimum of 3/16” steel plate.
4. The block shall have a minimum weight of 40 lbs. to properly tension the hand line.
5. A plastic kick tab shall be provided to permit adjustment of the rope tension.
6. The floor block shall be held in place and guided in the J-bar guides by two guide shoe assemblies, each consisting of two guides and one spacer made of 5/16" thick steel plates. Each guide shall be secured to the housing by means of two 3/8" hex head bolts and nuts.

E. Counterweight Arbors:
1. Arbor shall be 8’ long, or long enough to accommodate counterweights to balance its pipe batten and related equipment, whichever is longer.
2. The arbor top shall be a 1/4" steel plate formed into a channel with 3" sides, punched to receive 8 cables. A bolt and spacer shall tie the legs together and provide a tieoff point for the hand line. The front of the arbor top shall carry a 1- 1/2 ” high white line set number.
3. The arbor bottom shall be of similar construction, with counterweight rests to keep the weights from resting on the inner arbor rod nuts.
4. The top and bottom of the arbor shall be tied together by means of two 3/4" steel arbor rods and a 3/8" x 3" steel back plate. The arbor rods shall have three nuts at each end, the outermost being a lock nut.
5. Two guide assemblies shall be provided, each comprised of UHMW plates between steel backup plates or molded plastic shoe assemblies with stiffening ribs, secured to the arbor by means of two 3/8" hex head bolts and lock nuts.
6. Provide 12-gauge spreader plates (two minimum) on arbor rods so they can be spaced between counterweights on 2 foot centers. Provide a retaining collar on each rod, each with a set screw with red plastic knob for easy locking. The front retaining collar shall be welded to the top spreader plate.
7. Provide labels on the steel back plates showing the proper locations for the spreader plates.

F. Rope Lock:
   1. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The housing shall allow the use of a standard padlock to hold the handle in its closed position.
   2. In order to reduce noise during operation, there shall be a rubber bumper in the housing to silence the handle when it is opened. The dogs that grip the rope shall be machined to fit closely to reduce noise, and shall not require the use of washers.
   3. Adjustment for rope shall be from 5/8" to 1" by means of a nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.
   4. The handle shall be 9" long with a nylon powder or vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line.
   5. A coated, oval, welded steel ring shall be provided as a safety lock.
   6. The rope lock shall mount to the locking rail with four 3/8" hex bolts and lock nuts.

G. Locking Rail:
   1. The locking rail shall be 34 feet long and shall be punched to receive rope locks on 8 inch centers.
   2. Rope locks and index cards shall be mounted on a formed steel angle no smaller than 3-1/2" x 5" x 1/4".
   3. The onstage edge of the rail shall be sloped and punched to receive formed clips which hold index cards centered on the installed sets. Provide one numbered plastic write-on card for each installed set.
   6. Stanchions made from 2” steel square tube shall be provided on 5' (maximum) centers. They shall be long enough to anchor to the edge of the gallery. A continuous 3" x 2" x 1/4" angle shall help anchor the rail to the gallery and serve as a kick rail. Expanded metal mesh shall be provided between the stanchions.
   4. The entire locking rail shall be designed and installed to withstand a minimum up load of 500 pounds per foot.

H. Outrigger Brackets:
   1. Angle iron outrigger brackets shall be made of 3/16" x 1 3/4" x 13/4" angle and spaced not more than 10 feet apart. The brackets shall be attached to the wall battens of the arbor guide system so that the batten is located 10 feet above the gallery or stage floor. The brackets shall include clamps for attaching the batten.
   2. The outrigger batten shall be made from 11/2" I.D., schedule 40 pipe extending the full length of the locking rail. Specifications are the same as other battens.

I. Index Light:
   1. Each index light unit shall consist of a sheet steel housing containing lamp sockets mounted 12" apart and wired alternately on two circuits with leads and junction box at either end. Sockets shall be suitable for 40 Watt, A type lamps.
   2. Units shall be constructed so as to light the locking rail and prevent light from spilling on stage. The exterior of the index strip light shall be painted a matte black, the interior shall be white. Units shall be supplied in five and ten foot sections. Provide 30’ of index lights.
   3. Index strip lights shall be UL Listed.

J. J-Guide System:
   1. The complete J-guide system shall consist of vertical J’s, each sufficiently long enough to reach from the arbor pit to the head block beam, and allow the maximum amount of batten travel, located to receive sets on 8” centers. Vertical J’s shall be 1-3/4" x 1-1/2" x 3/16" extruded aluminum members.
   2. J-guides shall be held in place by extruded aluminum clips, which are bolted to the wall battens. The clips and J-guide shall be formed so that they lock together in accurate alignment. There shall be no need for holes or slots in the J-guides.

3. Horizontal wall battens shall be located on centers not to exceed 5'. Wall battens shall be 1-3/4" x 1-3/4" x 3/16" steel angles with factory punched holes on 2" centers to allow J-guides to be located on 8".
4. Wall battens shall be held in place by adjustable wall knees, consisting of a 5/16" x 1-1/2" steel knee and an 11 gauge 1" x 2" formed, slotted channel to aid in alignment made necessary by irregularities in the wall.
5. There shall be a top stop batten, a bottom stop batten and a floor batten, all of which shall be made of 13/4" x 13/4" x 3/16" steel angle. The top and bottom stop battens shall each have a 2" x 2" hardwood bumper securely bolted to the stop battens by 1/4" x 21/2" carriage bolts, nuts, and washers.
6. All other members of the J-guide system shall be assembled using 5/16" hex head bolts, lock nuts and washers.

K. Lift Cables:
1. All lift cables shall be 7 x 19 construction, galvanized utility cable, sized as required, and with breaking strengths as follows:
   3/16" diameter- 4,200 pounds
   1/4" diameter 7,000 pounds
   5/16" diameter- 9,800 pounds
2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.

L. Cable Fittings:
1. Cable clips shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation. Clips shall be drop forged Crosby or approved equal. Under no circumstances shall malleable cable clips be used in suspension or lifting lines.
2. Swaged sleeve fittings shall be copper Nicopress™. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with the appropriate Nicopress™ "Go - No go" gauge.
3. Eyes shall be formed over galvanized wire rope thimbles of correct size.

M. Alloy Trim Chains:
1. Trim chains shall be 36"*(914mm)* long, made of 7 mm, Grade 63, hardened alloy chain meeting OSHA 1910.184(e)(5). The chain shall have a RWL of 3,250lbs, shall be manufactured in the United States and have a black finish to eliminate glare. Each link is marked with the manufacturer's code and every 10th link has date code for traceability.
2. Connection between the end link and the lifting cable shall be made with a thimble and copper Nicopress® sleeve.
3. Chains shall be wrapped one and one half turns around the batten and attached back to the thimble at the end of the lift line with a 1/4" to 3/8" forged shackle. Adjustment is made by connecting the forged shackle into a link along the return side of the chain.
4. Trim chains shall have a recommended working load of at least 750lbs. when attached to *¼"(6.4mm)*, 7x19 GUC.

N. Pipe Battens:
1. All battens shall be 11/2" nominal diameter, schedule 40 pipe, 66' long. All joints shall be spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" hex bolts and lock nuts on each side of the joint.
2. Each end shall be covered with a bright yellow, closed end, soft vinyl safety cap at least 4 inches in length.
3. Pipe battens shall be painted black and shall have the center line marked with a 1" wide white stripe encircling the batten.

O. SureGrip™ Hand Line
   1. Hand line shall employ a 3strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.
   2. The hand line shall contain an identifying tape showing the manufacture's name, phone number, website, and year of manufacture.
   3. The hand line shall contain a red safety/wear indicator that will become visible as the rope nears the end of its useful life.
   4. The rope shall hold knots well, be easily spliced and be dense enough to allow it to be clamped in a rope lock without damage. Rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in humidity.
   5. Tape ends before cutting. Attach to arbor with two half hitches or bowline and tape end to standing line with electrical tape.

P. Counterweight:
   1. Counterweights shall be 6" wide x 133/4" long, with a U shaped cutout for the arbor rods. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 3/16" from nominal dimension.
   2. Opposite corners shall be notched for ease of handling. Alternate weights when stacking to provide finger holds when loading arbors.
   3. Provide 80% of weight 2" thick and 20% of weight 1" thick for ease of balancing.
   4. Provide a total of 12,400 pounds.

2.04 WINCH ASSEMBLIES FOR STAGE ELECTRICS

A. General
   1. The PowerAssist single axis hoist shall be used to motorize 4 counterweight rigging sets, for the stage lighting electric battens and cyclorama.
   2. The hoist shall be of a compact design with all required components integrated into its structure. It shall be floor mounted in a manner to properly accommodate a 1,000 lb upward load.
   3. The hoist assembly shall be less than 12" wide, and be able to automate a set that is located between existing sets on 6" or greater centers.
   4. When installed on a counterweight set of adequate capacity, the PowerAssist motorized counterweight set shall accommodate up to a 0 – 2,000 lb variable load at a speed of 25 fpm, without re-weighting. The hoist will handle an out of balance load equal to 50% of the set capacity. The counterweight arbor will be permanently loaded to 50% of the set capacity. The counterweight in the arbor shall be banded in place, and a method to impede the installation of additional counterweight provided. A sign shall be provided warning the user not to adjust the weight in the arbor.
   5. All components shall be designed to properly support the required loads.

B. Motor, Gearbox and Brake:
   1. A motor, gear reducer and primary brake shall be provided. Motors shall be totally enclosed fan cooled (TEFC) per NEMA MG1.
   2. The gearmotor shall have a minimum service factor of 1.0 and be provided with seals to effectively prevent leaks.
   3. Brakes shall be spring applied, direct acting, electrically released, and equipped with a manual release. The brake shall be an electromagnetic unit with a minimum retarding torque of 200% of motor full load torque. The brake shall be released by energizing the coil simultaneously with the motor winding to provide fail-safe braking in case of power failure.

C. Drive Medium
   1. The drive medium shall allow the use of a standard head block without modification and shall be positively driven in a manner that will allow repeatable positioning.

2. The drive medium shall have a minimum design factor of 10:1
3. Roller chains shall have a double leaf construction. UHMW chain guides shall be provided to ensure positive engagement of chain and sprockets, even with slack in the drive chain.
4. The portion of the drive medium that runs on the head block shall operate at the same pitch diameter as the lift lines so that they operate at the same speed, to avoid excessive cable wear and “jumping” caused by differing speeds.

D. Limit Switches
1. All hoists shall have positively actuated limit switches for normal end of travel. Actuation of the normal end of travel limit switches shall only allow movement away from the limit switch.
2. Positively actuated limit switches shall be provided for over travel, redundant to the normal limits. These shall use a separate circuit to positively disconnect power from the hoist, using a UL580E Type 2, non-welding, positive break contactor. An override mechanism to allow resetting of the over travel limits shall provided.

E. Motor Controllers:
1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL Standard 508, and be “touch safe” per IEC 204-1 “Protection against direct contact” rules.
2. The controller shall be sized to match the hoist motor horsepower. Overload and overcurrent protection shall conform to UL and NEC requirements.

F. Control Station:
1. Control stations shall be contained in the hoist assembly, and contain hold to operate (dead man) Up and Down pushbuttons for each hoist. A key operated On / Off switch shall be provided.
2. A red, mushroom head emergency stop pushbutton shall be provided, which will disconnect power to the hoist through a circuit meeting NFPA-79 requirements.
3. A “Service” indicator shall be provided to alert the user when regular system service is required.
4. Panel components (pushbuttons, key switches, switches, indicators, E-stop switches, and the like) shall be industrial grade units.

G. Position Control
5. The user shall be able to set four preset stop positions. The hoist shall stop at each preset position, and an “At Target” indicator will illuminate. Releasing and pressing the Up or Down button again will move the load to the next preset position.
6. Preset positions are set by the user, by moving the load to the desired position, and performing a simple control sequence.
7. The system shall provide reliable, accurate positioning within 1/16″ of the target position.
8. A solid state position encoder shall be provided.
9. Control stations shall be located at the locking rail in the position normally occupied by the rope lock.

H. All other components shall be as for manually operated linesets.

2.05 STAGE CURTAINS AND TRACKS:

A. Description and Sizes: Curtains shall be provided in accordance with the following:

Description	Qty	Height	Width	Fullness	Fabric
Auditorium:					
Grand Valance	1	10’	60’	75%	Heavyweight velour
Main Drape	2	22’	30’	75%	Heavyweight velour
Border	3	10’	60’	50%	Synthetic velour
Leg	6	22’	10’	50%	Synthetic velour
Rear Traveler	2	22’	30’	50%	Synthetic velour
Blackout curtain	1	22’	62’	50%	Synthetic velour
Cyclorama	1	22’	62’	0%	Seamless muslin
Scrim	1	22’	60’	0%	Sharkstooth
Drama Room:					
Leg	12	16’	10’	50%	Synthetic velour

B. Fabric types:
1. Heavyweight Velour. Inherently flame retardant 25 ounce synthetic velour. Standard color as selected by owner’s representative.
2. Synthetic Velour. Inherently flame retardant 22 ounce polyester. Standard color as selected by owner’s representative.
3. Scrim: Sharkstooth scrim, seamless, black.
4. Muslin: Sheer, plain-woven fabric, seamless, white.

C. Flame Retardancy: Cotton fabrics and other flammable fabrics shall be chemically mill treated for flame retardancy according to the requirements of the National Fire Protection Association’s NFPA #701.
1. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.

D. Fullness: See above for fullness of each curtain.
0% = flat, no extra material.
50% 100% = additional fabric to be included, exclusive of turnbacks and hems.

E. Seams: Seams between strips shall be single stitched without puckers using thread of matching color. All fabrics with a grain or pile shall have all strips running in the same direction.

F. Pleats: Pleats shall be box type on 12" centers. Valances and borders are to have their pleats arranged to conceal the seams.

G. Top Finish: 31/2" black nylon webbing shall be double stitched to the top of the curtain with 1" of face fabric turned under the webbing.
1. Brass rustproof grommets shall be inserted in pleat centers (12" centers on flat curtains). Grommets shall be used as follows:
#2 grommets muslin, lightweight fabrics.
#3 grommets unlined velour, medium weight fabrics.
#4 grommets lined velour, heavy weight fabrics.
2. Trackmounted curtains shall be supplied with plated wire Shooks. Battenmounted curtains are to be supplied with 36" braided #4 cotton tie lines. Tie lines shall be black or

white to best match the curtains with the center line in alternate color to aid in hanging curtains.

H. Bottom Hems:
   1. Valances and borders shall have 4" bottom hems.
   2. All full height curtains shall have 6" bottom hems complete with separate canvas-lined interior chain pockets filled with 3/16” proof coil chain. Chain pockets shall be stitched so that the chain will ride 2" above the finished bottom edge of the curtain. Chain shall be tacked at the ends of the chain pocket to prevent bunching.
   3. Scrims, drops and cycloramas shall have an additional pipe pocket sewn to the back of the hem and shall be furnished with a 1/2" pipe batten, threaded and coupled every 10 feet using low profile couplings.

I. Side Hems:
   1. House (Main) Curtain shall have 1/2 width of face fabric turned back at the leading edge.
   2. All traveler curtains shall have 1/2 width of face fabric turned back at the leading edge.
   3. All other side hems shall be 2".

J. Scrim: Fabricate from sharkstooth scrim fabric, sewn flat with no seams, and selvage to the rear. Provide 6 inch pipe pocket at bottom with a 6 inch flap of same fabric in front of pocket. Provide double-stitched jute webbing at top with not less than No. 2 brass grommets spaced at 12 inches o.c. and 1 inch from corner of curtain. Provide not less than a 2 inch double-folded side hem and a 4 inch bottom hem.

K. Cyclorama: Fabricate from seamless muslin fabric, sewn flat with no seams, and selvage to the rear. Provide 6 inch pipe pocket at bottom with a 6 inch flap of same fabric in front of pocket. Provide double-stitched jute webbing at top with not less than No. 2 brass grommets spaced at 12 inches o.c. and 1 inch from corner of curtain. Provide not less than a 2 inch double-folded side hem and a 4 inch bottom hem.

L. Curtain Track for Auditorium Stage:
   1. Track shall be of 14 gauge galvanized construction, entirely enclosed except for the slot in the bottom. Each section of track less than 20 feet shall be in one continuous piece. Splice clamps shall be permitted for section lengths over 20 feet.
   2. Carriers shall be constructed of nylon, supported from two heavy-duty polyethylene wheels held in the ball bearing by a nickel-plated steel rivet. Each carrier shall be equipped with a freemoving swivel and sufficient trim chain to accommodate a curtain Shook. Each carrier shall have a backpack (rear-fold guide). Rubber washers shall be provided between each back-pack and carrier to reduce noise.
   3. The Master Carrier block shall be constructed of plated steel having two cable clips to clamp the cord to the carrier. Four wheels in pairs identical to the single carrier above shall support the block.
   4. Live and dead end pulleys shall be adjustable, equipped with oil impregnated sleeve bearing wheels on adequately guarded plated steel housings. End stops at each track end and one adjustable floor pulley with sandbag shall be furnished. Stretchresistant, fiberglass center operating cord shall be 3/8" in diameter.
   5. Track shall be rigged for biparting operation with a 36" center overlap. Hanging clamps will be provided for suspension at six foot maximum intervals.
   6. Operating line shall be 3/8” diameter, black, stretch resistant rope with spun polyester outer jacket braided over solid aramid core.
   7. All steel components shall be zinc plated to resist corrosion.

M. Curtain Track for Drama Room:
   1. Track shall be 11 gauge extruded aluminum Ibeam construction consisting of a center rib and top, intermediate and bottom flanges.
   2. Each curtain carrier shall be spaced on 12" centers and shall be of steel construction to include two nylon tired ball bearing wheels rolling on two separate parallel treads. Each carrier shall contain a free moving plated swivel to accommodate curtain snap hook. Two rubber bumpers shall be attached to each carrier to function as noise reducers.
   3. Curves shall be formed on the job.
   4. Track shall be rigidly supported from ceiling clamps or hanging clamps on four-foot maximum centers.

2.06 PIPE GRID

A. Pipe grid shall be constructed from lengths of 11/2" nominal I.D. schedule 40 iron pipe. All joints shall be sleeve spliced with 18" long sleeves with 9" extending into each pipe and held by two 3/8" hex bolts and lock nuts on each side of the joint. Grids shall be installed as indicated on the drawings with pipes intersecting on four foot by four-foot centers.

B. Intersecting pipes shall be joined with a Clancy #015-100 Cross Grid Connector or by an approved equal. The cross grid connector shall have a recommended working load of at least 2,500 lbs.

C. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.

D. The grid shall be rigidly hung from the overhead steel structures on centers not exceeding 8 feet in either direction using 1/4" 7x19 galvanized aircraft cable ending in 6" x 3/8" forged turnbuckles attached to pipe clamps or connector strip hanging brackets. At each hanging point the chain or cable shall attach to the overhead structure with an appropriate fitting. Cables shall be formed over thimbles of correct size and fastened with two forged cable clips or Nicopress sleeves crimped three times. Turnbuckles shall be moused after final trim.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Rigging Contractor shall be responsible for storage of stage equipment, tools, and equipment during the period of the installation.

B. Extent: All specified equipment shall be installed by fully trained superintendents and workmen. Equipment shall be installed in a workman like manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.

C. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).

D. Alignment: Mule blocks, cable rollers and guides shall be installed, as required, to provide proper alignment, to maintain specified fleet angles, and to prevent contact with other surfaces.

E. Attachments: All equipment shall be securely attached to the building structure. Underhung head blocks and mule blocks shall be welded in place unless otherwise directed.

F. Finishes:
   1. All welds must be touched up to match disturbed finishes.
   2. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.02 CLEAN UP

A. The Contractor shall be responsible for clean up, including removal of packing materials etc. and the protection of surfaces or equipment provided by other contractors.

3.03 INSPECTION AND TESTING

A. Inspection: During the installation of equipment the Rigging Contractor shall arrange for access as necessary for inspection of equipment by the Owner's representatives.

B. System Inspection & Pre-Testing By Rigging Contractor: On completion of installation and testing the Rigging Contractor shall conduct a complete pre-test of the system to ensure it is working properly and in conformance with this specification. This shall include a complete test of all electrical systems and components. All tests shall be conducted as if the Architect or Consultant were present and appropriate corrections made before the final inspection. Inspection shall be done using the rigging equipment manufacturer's written inspection forms.

C. Special Testing: If specifications, the Architect's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Rigging Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.

D. Completion Testing: Upon completing the installation of all equipment specified under this section, the Contractor shall notify the Architect, who will schedule an inspection. At the time of inspection, the Rigging Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Owner's representative. Any equipment, which fails to meet with approval, shall be repaired or replaced with suitable equipment and the inspection shall be rescheduled under the same conditions as previously specified. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of, and access to, all equipment. Final approval will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.

E. Manuals and instruction in the operation of the equipment shall be provided in accordance with 1.05.

3.04 FOLLOW-UP INSPECTION

A. One year after the completion of installation, the Rigging Contractor shall return to the site and provide the following services:
   1. Complete inspection of the rigging system.
   2. Make all required adjustments.
   3. Correct all warranty items.
   4. Provide recommendations for necessary repairs or changes not included in the warranty.
   5. Conduct a 1 hour rigging operation and safety class.
   6. Provide a written proposal for the next year's maintenance visit.

END OF SECTION

SECTION 11 66 23
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basketball backboards, goals, and support framing.

B. Floor sleeves for net and goal posts.

C. Wall mounted protection pads.

D. Volleyball nets and posts.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete floor slab to receive floor sleeves and anchors.

B. Section 26 05 83 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

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

D. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

B. Electrically Operated Equipment: Coordinate location and electrical characteristics of service connection.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
   1. Electrical characteristics and connection locations.
   2. Fire rating certifications.
   3. Manufacturer's installation instructions.

C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gauge of metal, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section; utility requirements as to types, sizes, and locations.

D. Samples: Submit samples of wall pad coverings in manufacturer's available range of colors.

E. Operating and maintenance data for each operating equipment item.

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. Installer Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.

C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide standard manufacturer warranty for all sports and physical eduation equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gymnasium Equipment:
   1. ADP Lemco, Inc: www.adplemco.com/#sle.
   2. Draper, Inc: www.draperinc.com/#sle.
   3. Jaypro Sports, LLC.
   4. Performance Sports Systems: www.perfsports.com/#sle.
   5. Porter Athletic Equipment Company: www.porterathletic.com/#sle.
   6. Sportsfield Specialties.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

D. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.

E. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.03 BASKETBALL

A. Basketball System: Backstop assembly, backboard, and goal.
   1. Manufacturers:
      a. ADP Lemco, Inc: www.adplemco.com/#sle.
      b. Draper, Inc: www.draperinc.com/#sle.
      c. Jaypro Sports LLC.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Ceiling-Suspended Backstop Assemblies: Capable of mounting both rectangular and fan-shaped backboards.
   1. Framing: Center strut; forward folding framing.
   2. Folding Control System: Electric hoist that folds backstop with 115 volt actuator, integral limit switches that provide automatic shut-off in both positions, and safety catch with automatic reset.
   3. Height Adjuster: Raises or lowers assembly by 2 feet (610 mm) to adjust goal height.
      a. Height Control System: Manual winch.
   4. Framing Color: As selected from manufacturer's standard selection.
   5. Manufacturers:
      a. Jaypro Sports LLC 817-FFRB.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Backstop Auto Lock, Safety Strap
   1. Model No. SBAL-30 safety strap by Jaypro Sports, Waterford, CT.
   2. Provide one for each backstop.

D. Backboards: Tempered glass, rectangular shaped.
   1. Frame: Brushed aluminum edge, steel mounting.
   2. Dimensions: 42 inch high by 72 inch wide

3. Markings: Integrally manufactured.
4. Color: As selected from manufacturer's standard selection.

E. Goals: Steel rim, mounted to backboard, with attached nylon net; complete with mounting hardware.
1. Net Attachment Device: Tube-tie.
2. Breakaway mechanism, adjustable.
3. Finish: Powder coat orange.

2.04 FLOOR-MOUNTED EQUIPMENT

A. Volley Ball Nets and Posts: Two court system of adjustable posts, net, and tensioning winch meeting requirements for FIVB, USA Volleyball, NCAA and NFHS competition requirements.
1. Posts: 3-1/2 inch (89 mm) O.D. schedule 80 aluminum tube with 1 inch (25 mm) height adjustments between 42 and 96 inches (1.07 and 2.4 m).
2. Net: 4 inch (101 mm) square #36 nylon cord with vinyl coated polyester hem, double stitched around the perimeter.
3. Tensioning Winch: Manual crank heavy duty, self-locking worm gear mechanism.
4. Antenna and boundary marker.
5. Protective Pads: Polyethylene foam covered with polyester reinforced vinyl fabric.
6. Manufacturers:
a. Jaypro PVB-1500.

B. Floor Sleeves for Posts: Metal sleeve, with latch cover, cast into concrete subfloor to hold poles for nets and goals; installed flush with finish floor surface.
1. Latch Cover: Chrome plated, round; tamper resistant lock with key.
2. Sleeve: Aluminum.
3. Depth of Sleeve: 9 inches (230 mm) from floor surface to bottom, including latch cover.

2.05 WALL PADDING

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece. (Wrestling room and gymnasium)
1. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84 as a complete panel.
2. Covering: Vinyl-coated polyester fabric, mildew and rot resistant.
a. Color: As selected from manufacturer's standard range.
b. Texture: Embossed leather-look.
c. Fabric Weight: 14 oz/sq yd (0.52 kg/sq m), minimum.
3. Foam, Fire-Rated: Open cell polychloroprene (Neoprene), with 5.5 pcf (90 kg/cu m) nominal density.
4. Foam Thickness: 2 inches (50 mm).
5. Backing Board: Oriented strand board or fire-retardant-treated plywood.
a. Thickness: 3/8 inch (9.5 mm), minimum.
6. Panel Dimensions: 24 inch wide by 72 inch long, including nailing margins.
7. Mounting: Removable; Z-clips fixed to wall and to padding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

D. Verify that electrical services are correctly located and have proper characteristics.

3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.

C. Install equipment rigid, straight, plumb, and level.

D. Secure equipment with manufacturer's recommended anchoring devices.

E. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

F. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration; lubricate equipment as recommended by manufacturer.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 68 33
ATHLETIC FIELD EQUIPMENT (ALTERNATE #1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Football field equipment.

B. Soccer field equipment.

C. Discus throw system equipment.

D. Discus Cage.

E. Shot Put/Hammer throw system equipment and accessories.

F. Jump sand pit equipment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Footings for field equipment.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

D. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing 2020a.

E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.

F. ASTM B108/B108M - Standard Specification for Aluminum-Alloy Permanent Mold Castings 2019.

G. ASTM B179 - Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes 2018.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide athletic field equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.

C. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.

D. Samples: Submit color chart for each item that color must be selected showing full range of colors and finishes.

E. Maintenance Data: Submit manufacturer's recommended maintenance instructions and list of replaceable parts for each athletic field equipment item, along with supplier's address and phone number.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Athletic Field Equipment:
   1. ADP Lemco, Inc.
   2. Jaypro Sports.
   3. Performance Sports Systems.
   4. Sportsfield Specialties.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ATHLETIC FIELD EQUIPMENT - GENERAL

A. High School Sports: Provide equipment that complies with NFHS requirements.

B. Soccer Sports: Provide equipment that complies with FIFA requirements.

C. Mount supporting posts in concrete footings, unless otherwise indicated, refer to Section 03 30 00 for additional concrete footing installation requirements.

2.03 FOOTBALL FIELD EQUIPMENT

A. High School Goal Post (2): Rotating Base Plate Mount football goal post with single support post, crossbar and two uprights.
   1. Uprights, galvanized steel with powder coating and top at 30 feet (9.1 m) above grade, with 4 inch outside diameter and clearance between uprights of 23 feet - 4 inch (7.1 m); mount wind flags to top of each upright.
   2. Crossbar that supports uprights on each end, galvanized steel with powder coating and 6.625 inch outside diameter; mount with 10 feet (3.0 m) of clearance above grade.
   3. Support post, galvanized steel with powder coating with 6 inch outside diameter.
      a. Provide 8 feet (2.44 m) curved offset gooseneck type support post and connected with crossbar.
   4. Powder Coat Color: Yellow.
   5. Rotating base plate mounting kit.
   6. Access Frame Kit (2): 1/8 inch aluminum with 1 inch PVC Drain Stub, two half moon filler plugs and retractable safety clamp system.
      a. Basis of Design: GP830HSR by Sportsfield Specialties.

B. Football Goal Post Padding: Wrap-around pad for goal supporting post, using hook and loop fastener straps for attachment around post.
   1. Round Post: 6-5/8 inch (168 mm) outside diameter.
   2. Goal Post Pad: 7 inch inside diameter, 18 inch outside diameter.
   3. Pad Height: 6 feet (1.83 m).
   4. Padding Material: High density urethane foam, at least 5.5 inch thick with 18 ounce (510 g) mildew resistant and ultraviolet (UV) resistant coated vinyl.
   5. Color a: As selected by Architect.
   6. Basis of Design: GPPRDG by Sportsfield Specialties.

C. Football Play Clock Post Padding: Custom sized padding for play clock posts, color as selected by Architect.

D. Football End Zone Pylons (8): Two sets of four (4) vinyl covered foam football end zone pylons with self-standing weighted bases, 18 inch high by 4 inch long by 4 inch wide.

E. Field Scoreboards:
   1. Basis of Design: Daktronics FB-2020 with MX-1 and enclosure by Daktronics or approved equal.

2. Scoreboard can be modified to also score track and soccer. To score HOME and GUEST to 99, displays DOWN, TO GO, BALL, on and QTR (quarter) information, indicated possession and displays period time to 99:59.9. During the last minute of the period, it displays time to 1/10th of a second. Captions for scoring tack are provided on changeable panels. Integral horn and LED displays for time, scores, quarter, down, yards to go, ball location, time outs left, ball possession.
3. Nominal Dimensions: 8'-0" high, 18'-0" wide.
4. Power Requirement: 300 watts or as standard with manufacturer.
5. Color: As selected by Architect.
6. Digits: LED, 24" high, red or amber led digits. Individual digit panels are fastened with a maximum of three screws for easy access and quick removal. Rivets are not an acceptable fastening method.
7. Captions: All captions 12" min height, 15" if standard with manufacturer. Team names on changeable panels. Soccer, track, and lacrosse captions on changeable panels.
8. Arch truss name and logo accent.
9. Scoreboard supports: powder coated steel, 12'-0" to bottom of scoreboard

F. Play clock (with custom padding) for each end of the field with mounts and control wiring required for complete installation. Daktronics TI-2003, or approved equal.
1. Play clock supports: Powder coated steel, 18'-0" to bottom of play clock.

G. Scoring Console - 1 per scoreboard, Daktronics All Sport 5000, or approved equal.
1. Console is a multi-sport controller capable of scoring football, lacrosse, field hockey, track and soccer through the use of keyboard inserts.
2. Console recalls clock, score and period information if power is lost.

H. Scoreboard supports: Steel Pipe: ASTM A 53, standard weight (schedule 40), unless another weight is indicated or required by structural loads. Sized by manufacturer to code required wind loads and weights of scoreboard assembly.

2.04 SOCCER FIELD EQUIPMENT

A. Manufacturers:
1. Basis of Design: Sportsfield Specialties SG824R.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Portable Soccer Goal (2): Uprights and cross bar, white colored, and constructed of 4 inch (102 mm) round extruded aluminum tubing, with backstays and rear stabilizing bar constructed of 1-5/8 inch (41.3 mm) diameter galvanized steel tubing with plated connection hardware.
1. Size: 8 feet high by 24 feet wide by 8 feet deep (2.44 m high by 7.32 m wide by 2.44 m deep) in accordance with NCAA, NFHS, and FIFA requirements.
2. Provide ground "J" stake anchors and net clips in compliance with U.S. CPSC safety requirements.
3. Soccer Nets: Polypropylene material, white colored. 5mm braided, knotless white high tenacity and 4” square Mesh – 8.2’H x 24.4’L x 4.3’B x 8.6’D.
4. Wheel Assembly Kits (2): Provide non-flat type removable swivel wheels, four total, that allow for easy mobility of goal.
5. Lockdown kits (2): Basis of Design - SG2S by Sportsfield Specialties.

2.05 DISCUS EQUIPMENT

A. Discus System
1. Basis of Design: Sportsfield Specialties - TFD Discus ThrowForm
2. 10' x 10' x 6” aluminum two piece forming assembly
a. Throw ring: rolled 4" x 1/4" aluminum flat bar with 98 1/2 " inside diameter and ten 1/2" diameter drainage pipes.

B. Discus Cage
1. Basis of Design: Sportsfield Specialties - DCHS Discus Cage.
2. Upright Poles: 4" aluminum tube, 36" rolled offset, 14'-3 3/8" above finish grade.
3. Super durable black powder coated finish, enhanced resistance to UV.

4. Ground Sleeve: 30” Depth, aluminum, welded leveling plate, alignment bolt, press fit ground sleeve plug.
5. Main Net: 1-3/4” square mesh black nylon net, 13' H x 54' L
6. Retractable Pulley System: Swivel Pulleys, Tethers, and Rope Cleats
7. Includes Swivel Pulleys, Tethers, and Rope Cleats

2.06 SHOTPUT/HAMMER EQUIPMENT

A. Shotput/Hammer System (1)
1. Basis of Design: Sportsfield Specialties - TFSPTF084
2. 10’ x 10’ x 6” Welded Aluminum Two (2) Piece Forming Assembly
3. Throw Ring Fabricated of 4” x ¼” (0.25”) Thick Rolled Aluminum Flat Bar Welded to Forming Assembly
4. 0.19” 5052 Welded Aluminum Cross Bracing and Staking Gussets
5. 84” Inside Diameter Shot Put/Hammer
6. ¾” (0.75”) Recessed Concrete Installation Screed Line
7. Ten (10) 5/8” (0.625”) Diameter Drainage Tubes Welded Flush

B. Removable Toe Board (1)
1. Basis of Design: Sportsfield Specialties - SPTBCARHS
2. 3-1/4”H (4” Above Recessed Concrete Pad) x 4-1/2”W x NFHS Compliant Length and Shape
3. Cast Aluminum Construction, Super Durable White Powder Coated Finish, Black Vinyl Sector Lines

2.07 JUMP SAND PIT EQUIPMENT

A. Jump Sand Pit with Sand Catchers (2)
1. Basis of Design: Sportsfield Specialties - SPSCHS
2. High School Sand Pit with Sand Catchers:
3. Base Forms Fabricated of 1/8” (0.125”) Thick Aluminum, 150mm (6”) Wide x 2m (6.56’) Long x 395mm (15.6”) High
4. Pre-Fabricated Ninety Degree (90°) Corner Base Forms Fabricated of 1/8” (0.125”) Thick Aluminum, 150mm (6”) Wide x 1.72m (5.66’) Long x 395mm (15.6”) High
5. Sand Catcher Units Fabricated of 1/8” (0.125”) Thick Aluminum and Have a Forty-Five Degree (45°) Angled Inside Cover Ledge
6. Pre-Fabricated Ninety Degree (90°) Corner Sand Catcher Units Fabricated of 1/8” (0.125”) Thick Aluminum and Have a Forty-Five Degree (45°) Angled Inside Cover Ledge
7. Sand Catcher Units Measure 305mm (12”) Deep x 500mm (19.6”) Wide and Include Four (4) Integral Drainage Tubes, Aluminum Mesh Grate Mat Supports and Perforated ½” (0.5”)Thick Black Rubber Mats

B. Jump Sand Pit Cover (2)
1. Basis of Design: Sportsfield Specialties - SPHSCVR
2. Welded 1/8” (0.125”) Thick Aluminum Panel Cover Set with Recessed Stainless Steel Lift Handles and ½” (0.5”)Recess to Accept Synthetic Track Material by Others
3. Forty-Five Degree (45°) Angled Ends Conducive with Sand Pit Cover Ledge
4. Coat with synthetic track surfacing to match existing track surfacing.

C. Jump Sand Pit Cover Cart (2)
1. Basis of Design: Sportsfield Specialties - MC510
2. Multipurpose cart, aluminum construction, durable powder coated finish.
3. Dimensions: 5’W x 10’L
4. Front Wheels: 12” diameter hard rubber swivel caster
5. Back Wheels: 12” diameter hard rubber rigid caster

D. Jump Boards (4)
1. Basis of Design: Sportsfield Specialties - LTJTOB8BL
2. 8’’ Long and Triple Jump Take-Off Board System with Blanking Lid
3. White Synthetic Polyboard with Textured Surface

4. Extruded Aluminum Insert/Spacer
5. Formed Aluminum Blanking Lid
6. 16 Gauge (0.60”) 304 Stainless Steel Tray

2.08 MATERIALS

A. Steel Pipe and Tube: Complying with ASTM A135/A135M, ASTM A500/A500M, or ASTM A513/A513M; hot-dip galvanized and free of excess weld and spatter.
   1. Tensile Strength: 45,000 psi (310 MPa), minimum.
   2. Yield Point: 33,000 psi (225 MPa), minimum.
   3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A123/A123M; remove tailings and sharp protrusions and burnish edges.

B. Extruded Aluminum: ASTM B221 or ASTM B221M, Alloy 6061, 6062, or 6063.
   1. Tensile Strength: 39,000 psi (270 MPa), minimum.
   2. Yield Point: 36,500 psi (250 MPa), minimum.

C. Cast Aluminum: ASTM B26/B26M, ASTM B108/B108M, or ASTM B179.

D. Powder Coating for Steel: Electrostatically applied and oven cured polyester powder over electrostatic zinc coating.

E. Concrete: As specified in Section 03 30 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install athletic field equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.

B. Install athletic field equipment without sharp points, edges, or protrusions; entanglement hazards or pinch, crush, or shear points.

3.02 CLEANING

A. Clean athletic field equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

B. Clean athletic field area of excess construction materials, debris, and waste.

C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.03 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

DIVISION 12 – FURNISHINGS

12 24 00	WINDOW SHADES
12 61 00	FIXED AUDIENCE SEATING
12 66 13	TELESCOPING BLEACHERS

SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Maintenance contracts.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: Five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   2. MechoShade Systems LLC: www.mechoshade.com/#sle.
   3. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades for exterior and interior windows as shown on drawings:

1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    a. Fabric: Fabric type and openness (0-14) factor as selected by Architect. Finish selected by architect from manufacturer's available contract colors.
        1) Fabric Weight between 6 oz. - 20 oz.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
3. Roller Tubes: As required for type of shade operation.
    a. Material: Extruded aluminum, clear anodized finish.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
4. Hembars: Designed to maintain bottom of shade straight and flat.
    a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
5. Manual Operation for Interior Shades:
    a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    b. Drive Chain: Continuous loop beaded ball chain, 95 pounds (43 kg) minimum breaking strength. Provide upper and lower limit stops.
6. Accessories:
    a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

D. Training: Train Owner's personnel on operation and maintenance of system.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.07 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 12 61 00
FIXED AUDIENCE SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed, upholstered theater chairs.

B. Support standards.

C. Chair accessories.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

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

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2021).

D. ASTM D3597 - Standard Performance Specification for Woven Upholstery Fabrics—Plain, Tufted, or Flocked 2002, with Editorial Revision (2018).

E. ASTM E1352 - Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies 2016.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

G. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.03 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, chair layouts and dimensions and seat numbering scheme.
   1. Field Measurements: Verify seating layout by field measurements and record field dimensions on shop drawings.

D. Selection Samples: Manufacturer's color charts and swatches for fabric upholstery, indicating full range of materials, colors, and patterns available.

E. Verification Samples: Full-size two-seat fabricated sample of each type of chair specified, including all accessories and one end panel, illustrating all finishes and workmanship to be expected in the finished Work; approved sample may be incorporated into the Work.

F. Maintenance Materials:
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Seats: Quantity equal to 5 percent of total installed, but not less than one of each type and width of seat, furnished from same production run as that installed.
   3. Extra Fabric: Quantity sufficient for reupholstering 5 percent of installed seating.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the seating manufacturer to be qualified for installation of specified seating.

B. Fire Retardance of Upholstered Seating: Self-extinguishing when mock-up is exposed to smoldering cigarettes in accordance with ASTM E1352 or NFPA 261.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver seats to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store seating units in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for additional mock-up requirements.

B. Construct mock-up with at least 2 seats in each of 2 rows at location indicated. Approved mock-up will serve as quality standard for completed installation. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Theater Seating:
   1. Hussey Seating Company; Quatro Traditional: www.husseyseating.com/#sle.
   2. SERIES Seating, LLC: www.seriesseating.com/#sle.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Cast Iron: ASTM A48/A48M, Class 25A minimum, free of air holes and casting imperfections, all edges ground smooth.

B. Steel Plates, Bars, and Tubes: ASTM A36/A36M.

C. Laminated Plastic: NEMA LD 3, Type 1, Grade GP 50, nominal thickness 0.050 in (1.27 mm); colors and patterns as selected from manufacturer's standards.

D. Polypropylene Sheet: Molded high density plastic with minimum tensile strength of 3300 psi (23 MPa), integral color pigments, and textured, scuff-resistant surface finish.

E. Polyurethane Foam: Density not less than 1.8 lb/cu ft (28.8 kg/cu m), fire retardant, non-hardening and non-oxidizing, with high resistance to alkalis, oils, moisture, and mildew.

F. Upholstery Fabric: ASTM D3597 heavy-duty plain woven nylon fabric, treated to resist cigarette ignition and staining; color and pattern as selected by Architect.

2.03 UPHOLSTERED CHAIRS

A. Fixed seating system designed to permit radial installation using common middle support standards in each row and aisle standards aligned as indicated on drawings. Width of seats not less than 22 inches (559 mm), except exit seat locations may be reduced to 20 inches (508 mm) to complete specific row dimensions.

B. Backs: Fixed type; two-panel construction with fabric covering over padding and protective back panel, with installed height not less than 32 inches (813 mm) above finished floor.
   1. Padding: Polyurethane foam not less than 3 in (76 mm) thick bonded to structural support.
   2. Covering: Fabric bonded to padding and fastened by upholstery technique that facilitates replacement.
   3. Rear Panel: One-piece injection molded high-impact plastic, with scuff-resistant textured surface.

C. Seats: Hinged type, constructed to permit reupholstering without removing seat from chair.

D. Hinges: Self-lubricating, noiseless steel hinges with brass alloy bearings or nylon bushings, equipped with spring mechanism that causes unoccupied seat to rise automatically to uniform 3/4 fold, with 100 percent fold when additional pressure is applied.
   1. Provide push-back hinge mechanism that allows additional aisle space while seat is in an open position.

E. Arm Rests: Locate at aisles and between chairs; mount to support standard with concealed fasteners; exposed surfaces of molded high-impact plastic.

2.04 STANDARDS

A. Support Standards: One-piece cast iron, with integral mounting points for backs, seats, and arm rests, and integral floor anchoring points.

2.05 ACCESSORIES

A. Seat and Aisle Numbers: Manufacturer's standard seat numbers securely fastened to front edge of folding seats and row numbers securely fastened to aisle arm rests; anodized aluminum finish, with letters and numbers countersunk and filled with black paint.

2.06 FINISHES

A. Ferrous Metals: Manufacturer's standard two-coat baked enamel finish, applied over conversion coating appropriate to base metal.
   1. Color and Gloss: Match Architect's sample.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of fixed theater seating. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's installation instructions and approved shop drawings.

B. Anchor support standards securely to substrate with at least two anchoring devices recommended by manufacturer.
   1. Place standards in each row laterally so the standards at the aisle will be in alignment.
   2. Vary width of seats and backs as required to optimize sightlines, and comply with the ADA Standards for row and aisle widths.
   3. In curved rows, install standards to form smooth radius, without breaks or angled chords
   4. Attach components to standards with sufficient flexibility to compensate for convergence of seats toward the center.

3.03 ADJUSTING

A. Adjust seat mechanisms to ensure that seats in each row are aligned when unoccupied.

B. Repair minor abrasions and imperfections in painted finishes with a coating that matches factory-applied finish; replace units that cannot be repaired to unblemished appearance.

C. Replace upholstery fabric damaged or soiled during installation.

END OF SECTION

SECTION 12 66 13
TELESCOPING BLEACHERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Telescoping bleachers.
   1. Motor operated gymnasium bleachers.
   2. Manually operated wrestling bleachers.

B. Electric motor operators, controls, and internal wiring.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Connection of electric motors and controls.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

C. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.

D. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures 2021.

E. PS 1 - Structural Plywood 2009 (Revised 2019).

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 handling and requirements.
   3. Installation methods.

C. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
   1. Provide drawings customized to this project.
   2. Include Professional Engineer's seal on each sheet.
   3. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.

D. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches (50 by 50 mm) in size, illustrating colors and finishes available.

E. Verification Samples: For each custom colored finish, submit samples of actual finish or product, for verification of color selection.

F. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Manufacturer's installation crew.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Telescoping Bleachers:
   1. Interkal LLC: www.interkal.com/#sle.
   2. Irwin Telescopic Seating Company: www.irwintelescopicseating.com/#sle.
   3. Hussey Seating Company; Maxam: www.husseyseating.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TELESCOPING BLEACHERS

A. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
   2. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
   3. Wheelchair Spaces: Comply with ADA Standards as required for project.
   4. Operation: Some manual and some motor operated.

B. Design Loads: Design to withstand the following loading conditions:
   1. Live Load on Structural Supports: 100 psf (4.8 kPa), minimum, of gross horizontal projection.
   2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot (1750 N/m).
   3. Lateral Sway Stress on Structural Supports: 24 pounds per linear foot (350 N/m) of seat plank.
   4. Perpendicular Sway Stress on Structural Supports: 10 pounds per linear foot (146 N/m) of seat plank.

C. Dimensions:
   1. Rows:
      a. Gymnasium - 15 rows.
      b. Wrestling Room - 3 rows.
   2. Rise Per Row: 10 inches (254 mm).
   3. Row Depth: 26 inches (660 mm).
   4. Seat Height Above Tread: 6 inches (150 mm).

D. Structural Supports: Steel or aluminum; manufacturer's standard wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
   1. Design so that each row carriage so that it will individually support the design loads and is self supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
   2. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
   3. Bolting: Use lock-washers or locknuts.
   4. Wheels: Minimum 5 inch (125 mm) diameter by 1 inch (25 mm) wide, with non-marring rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
   5. Finish: Manufacturer's standard enamel or powder coating.
   6. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.
   7. Unlocking: Automatically unlock all rows before engaging retraction mechanism.

E. Motor Operation: Manufacturer's standard drive mechanism, using motor adequately sized for the purpose.
   1. Provide UL listed electrical components and wiring.
   2. Controls: Start, Stop, Forward, and Reverse in a single control unit.
   3. Control Station: Removable plug-in low-voltage pendant station, with first-row plug-in location for each motor.
   4. Limit Switches: Automatically stop operation when unit has reached fully open or fully closed position.
   5. Provide all wiring internal to bleacher units, to junction box located where indicated; ensure that wiring is not energized except during operation.
   6. Electrical Characteristics: 208/230V, 5 wire, 3-phase, 60 Hz.

7. Provide access to motor from front side of bleachers; a hinged front skirt or hinged section at least 30 inches (760 mm) wide is acceptable.

2.03 SEAT AND PLATFORM COMPONENTS

A. Seat/Fascia Assembly: Continuous, molded UV-stabilized high-density polyethylene plastic, seat minimum 1 inch (25 mm) thick, textured finish, homogeneous color throughout, color as selected from manufacturer's standard selection; approximately 18 inch (460 mm) long sections independently removable with tongue-and-groove or rabbeted interlock at end joints.
   1. Shape: Ergonomically contoured, with internal ribs spaced for natural flexibility; rear edge cantilevered to provide toe room of not less than 3 inches (75 mm); no openings to trap debris.
   2. Provide end caps of same material and finish on each exposed end.
   3. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.
   4. Seat and Row Numbers: Provide recessed pockets for number plates by others.

B. Platform, Tread, and Step Structure: Plywood continuously supported on front and rear with side joints tongue-and-grooved.
   1. Plywood: PS 1, 5-ply southern pine or polyethylene-overlaid douglas fir or southern pine, Grade A-C.
   2. Plywood Thickness: 5/8 inch (16 mm), minimum.
   3. Front (Nose), Rear, and Intermediate Supports: Steel channel or tube, hot-dipped galvanized.
   4. Provide end caps of same material and finish on each exposed end.
   5. Finish: High gloss clear urethane, both sides, unless polyethylene finished.

2.04 HANDRAILS AND RAILINGS

A. Provide the following railings:
   1. Aisle Handrails: Single post folding railing segment mounted in center of aisle at every other row beginning at row 2.
   2. End of Row Guardrails: Self-storing, at open ends of sections beginning at row 2.
   3. Height: 42 inches (1067 mm) above adjacent platform or tread.

B. Design handrails and railings to withstand the following loads:
   1. Concentrated Load on Handrails: 200 pounds (890 N) in any direction.
   2. Concentrated Load on Guardrails: 200 pounds (890 N) in any direction along top rail.
   3. Live Load on Handrails: 50 pounds per linear foot (790 N/m), applied in any direction.
   4. Live Load on Guardrails:
      a. Horizontal: 50 pounds per linear foot (790 N/m), applied at the guardrail height.
      b. Vertical: 100 pounds per linear foot (1460 N/m), applied vertically to top of guardrail.

C. Railing Construction: Round steel pipe or tube, with formed elbows at corners and caps at ends of straight runs.
   1. Steel: 1-1/2 inch (38 mm) minimum outside diameter, with 11 gauge, 0.12 inch (3.05 mm) minimum wall thickness; textured powder coat epoxy finish.

2.05 ACCESSORIES

A. Fillers and Closures:
   1. Ends of Retracted Units: Vinyl curtain, with school logo as selected by Owner.
   2. Top Row: Provide seat level rear filler panels to close openings between top row seat and wall; finish to match platforms.
   3. Vinyl Curtains: 18 ounce (510 g) vinyl with grommets; color as selected from manufacturer's standard palette.

B. Motion Monitor: Strobe light and warning horn rated at 150 dB, both of which operate continuously during movement of any section of bleachers; mount strobe light where it is clearly visible to entire bleacher installation.

C. Scorer's Table: 8 feet (2.44 m) wide by 15 inches (381 mm) deep; relocatable to any row of any section without mounting brackets.

D. Fasteners: Provide hardware and fasteners in accordance with manufacturer's recommendations.

E. Anchorage: As indicated on drawings; provide hardware in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are consistent with those on the shop drawings.

B. Verify that electrical rough-ins have been installed and are accessible.

C. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

D. 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 manufacturer's instructions.

B. Do not field cut or alter seats, fascia, or structural members without approval.

C. Provide manufacturer's field representative to inspect completed installation.

3.04 ADJUSTING

A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.05 CLEANING

A. Clean exposed and semi-exposed assembly surfaces.

B. Touch up finishes on damaged or soiled areas.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
   1. Location: On site using installed equipment.
   2. Time: As agreed between Owner and Contractor.

3.07 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

DIVISION 13 - SPECIAL CONSTRUCTION

13 12 50 PERMANENT GRANDSTANDS

SECTION 13 12 50
PERMANENT GRANDSTANDS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. Provide labor, material, equipment and supervision necessary to complete installation of permanent steel grandstand, including the following:
   1. Steel Substructure
   2. Decking System
   3. Concrete Foundation
   4. Press Box Support Structure
   5. Press Box

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers must have ten years of experience in the manufacture of bleachers and grandstands; manufacturer must exhibit proof of business existence for past ten years with documentation; welders must be AWS certified.

B. Installer Qualifications: Experienced in the proper installation of grandstands.

C. Source Quality Control: Mill Test Certification.

1.03 SUBMITTALS

A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.

B. Shop Drawings: Manufacturer to submit shop drawings sealed by a registered engineer and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws.

C. Certificates:
   1. Insurance Certificate
   2. Bid Bond

D. Color Samples: If applicable, submit samples of color family of desired colors.

1.04 SITE CONDITIONS

A. Field Site:
   1. Owner to make site accessible.
   2. Owner to verify site locations, benchmarks.

B. Underground Utility Line: Owner to clearly mark all underground utilities and obstructions and Owner to relocate all that conflict with grandstand.

B. Soil Test: Furnished by Owner.

1.05 BUILDING CODES

A. Must meet or exceed all State and Local applicable codes and in compliance with the International Building Code adopted by the jurisdiction and CABO/ANSI A117.1 Barrier Free Subcode.

1.06 WARRANTY

A. Permanent Grandstand shall be under warranty for a period of one year beginning at Date of Substantial Completion for Projects installed by Manufacturer. The warranty will provide for repair or replacement of failed components due to defect in materials and workmanship of installation for the specified period. This warranty excludes any other defects resulting from abnormal use in service, vandalism, weathering, oxidation, accidental or intentional damage or any occurrences beyond Manufacturer's control.

1.07 MAINTENANCE

A. Owner is to conduct annual inspection and required maintenance of grandstand to assure safe conditions. It is also recommended that a professional engineer or registered architect perform inspections biennially.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Southern Bleacher Company (800) 433-0912. Horizontal Beam Design.
B. Sturdi Steel.
C. Other manufacturers seeking to be approved must submit product literature on horizontal beam design to the Owner for review and receive approval from Owner seven days prior to bid date.

2.02 PERMANENT STEEL GRANDSTAND

A. Product Description
   1. Horizontal Beam Design: Home 265’ long x 9 rows (approx. 1,320 seating), with Press Box 12’ x 36’ and Press Box Support Structure 12’ x 36’
      Visitor 97’ long x 10 rows (approx.. 478 seating)

   2. Vertical columns are placed 18 feet 0 inches on center laterally and as shown on section views in drawings on center front to back.

   3. Horizontal beams are wide flange beams.

   4. Traverse bays are free of cross bracing the total length of the grandstand. Cross braces as C line columns 8’ above grade.

   5. Stringers are wide flange with steel angle rise and depth fabrication and are placed 6 feet on center.

   6. Front Walkway and Crosswalk
      a. Front walkway clear width 74 inches - home and visitor

b. Crosswalk – 54” Home side only

7. Entry stairs to be firmly anchored to uniformly poured concrete bases.
   a. Stair rise: 6 inches with aluminum closure and contrasting aluminum stair nose.
   b. Stair tread depth: 12 inches.
   c. Guardrails: As required by code.

   d. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.

8. Aisles:
   a. Aisles with seating on both sides to have discontinuous mid-aisle handrails. The handrails shall be discontinuous with breaks at intervals not to exceed five rows. These breaks shall have a clear width of at least 22 inches and not greater than 36 inches horizontally.
   b. Anodized aluminum handrails with rounded ends to be provided with an intermediate handrail below the main handrail.
   c. Aluminum tread nosing of contrasting color on aisle steps.
   d. Halfsteps shall be provided for riser heights above 8 inches.
   e. Halfsteps shall provide equal rise and run throughout aisle. Each shall have aisle nosing with non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H and riser closure with clear anodized finish.
   f. Aisles with a riser height of non-uniformity shall be indicated with distinctive markings as required by code.

9. Decking:
   a. Rise per row 12 inches, depth per row 26 inches.
   b. Each seat 17 inches above its respective tread.
   c. Semi-closed / full decking
   d. Mill Aluminum walking surfaces = Tongue and Groove
   e. Anodized Aluminum Bench Seat 2 x 10 (standard), Die #7758 with height of 1 1/2".

10. Guardrailing: To be at all sides of bleacher, entry stairs and ramps, portals, and landings. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner. All guardrails shall be secured to angle rail risers by galvanized fasteners. Railing shall be at heights as required by code for its location on the grandstand. Guard railing shall include intermediate railing, or galvanized chain link fencing fastened in place with galvanized fasteners and aluminum ties.

11. Handicap provision:

a. Quantity of wheelchair spaces: as shown on plans
b. Riser area adjacent to wheelchair spaces to have intermediate construction so 4 inch sphere cannot pass through opening.

B. Materials/Finishes
1. Substructures:
a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
b. Shop connections are seal welds.
c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
d. Painted steel finish is unacceptable.

2. Extruded Aluminum:
a. Seat Planks, Risers under seats and Railing are extruded aluminum alloy, 6063-T6. Clear anodized 204R1, AA-M10C22A31, b.Tread planks are extruded aluminum alloy 6063-T6 mill finish.
c. Railing: Extruded aluminum alloy, 6063-T6 clear anodized 204R1, AA-M10C22A31, Class II.

3. Accessories:
a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
b. Hardware:
(1) Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
(2) Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
(3) Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.
c. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H.

C. Fabrication:
1. Design Load:
a. Tread and Seat Area: 100 psf uniform live load.
b. Seat (Vertical): 120 lbs/lf.
c. Seat (Horizontal Sway): 24 lbs/lf parallel and 10 lbs/lf perpendicular to seat.
d. Handrail and Guardrail: 50 lbs/lf in any direction.
e. Handrail and Guardrail: 200 lbs concentrated in any direction.
f. Snow Loads: As per State adopted code.
g. Wind Loads: As per State adopted code.
h. Seismic Loads: As per State adopted code.

2. All manufactured connections to be shop welded.
a. Manufactured by certified welders conforming to AWS Standards.

2.03 PRESS BOX WITH METAL STRUCTURE

A. Product Description: Type II Construction

1. Press Box Support Structure: Independently supported but connected to rear of grandstand. Support Structure to be 12 feet wide x 36 feet long with 6 feet landing on both end. Pressboxes with wood framing are not acceptable.

2. Press Box Dimensions: 12 feet wide x 36 feet long with three rooms. Roof / Canopy as shown above top of pressbox and roof top access stair.

3. Press Box to be of open construction, allowing inspection of electrical wiring, switches and other components without destructive disassembly.

B. Materials/Finishes

1. Press Box Support Structure:
   a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.

   b. Shop connections are seal welds.

   c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.

2. Press Box: All materials shall be new and shall comply with ASTM specifications.
   a. Floor
      (1) Main support to be a galvanized steel floor frame sized to support structure and metal belly pan for support of insulation.
      (2) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6, mill finish. Attach Decking System to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. (Tongue & Groove or Standard extrusion aluminum or wood subfloor is not acceptable.)
      (3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville, or equal.

   b. Wall Structure
      (1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than these require engineered calculations for design.
         a) Steel framing shapes to meet one of the following ASTM's, A500 Grade A or B 45 ksi, A36 50ksi, A1011 CS Type B.
      (2) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-13, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville or equal.

      (3) Interior Finish
         (a) 1/2 or 5/8 inch vinyl coated gypsum panels (as required), Gold Bond vinyl-surfaced Durasan.
         (b) Cove Base: Vinyl 4 inches x .080.

      (4) Exterior Finish
         (a) 26 gauge prefinished R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal.

(b) Wall panels are attached with #12 TEK screws - 6” O.C. at the top, midpoint and bottom of the panels.
(c) Lap screws are placed at each end of the panels, at the intermediate supports, and at the midpoint between supports (TEK #14).
(d) All fasteners to be painted same color as exterior paneling.

c. Roof Structure
(1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
(2) Roof: 1/8 inch fourway steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylink roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8 inch fillet welds on 12 inch centers. Wood roofing materials are not acceptable.
(3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Johns Manville or equal.
(4) Cornice: 26 gauge steel prefinished to match metal siding.
(5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical lay in ceiling tile with removable tiles, per 2006 IBC or local code, applicable category per seismic zone, (in California per 2007 CBC, applicable category per seismic zone, ref. DSA IR 25-5).

d. Exterior Doors
(1) Full flush steel construction with hollow or polystyrene core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: Coordinated with press box siding color.
(2) Steel door frame (16 gauge) complete with 1/2 inch threshold and weather-stripping.
(3) Exterior Hardware: Yale 546F Exterior Trim, or equal. Handles shall be lever type that allow operation without tight grasping or twisting of the wrist. Keyed alike locks.
(4) Interior Hardware: Yale 2100 Exit Device, or equal. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.

e. Interior Doors
(1) Interior Hollow Core Birch Unit. Dimensions: 3 feet 0 inches x 6 feet 8 inches.
(2) Hardware: Handles shall be lever type that allow operation without tight grasping or twisting of the wrist.

f. Interior Walls
(1) Framing to be steel galvanized studs (25 gauge) 1 1/4 inch x 3 5/8 inch or 4 inch at maximum 2 feet on center.
(2) Finishes to be consistent with all other interior finishes.
(3) Must have fixed glass window in interior and end walls at front work bench for proper sight lines.

g. Windows
   (1) Frame: Extruded aluminum single hung, vertical sliding unit**,** thermal break. Windows in end walls and part ion walls fixed glass.
   (2) Sash: Tilt toward inside for easy cleaning.
   (3) Glazing: Clear tempered panes.
   (4) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.
   (5) Finish: Electrostatically applied acrylic enamel.

h. Work Bench
   (1) 1 inch thick x 21 inch wide clear anodized aluminum work bench supported by 4 inch x 2 1/2 inch x 14 gauge steel. Countertops heights shall be constructed to allow wheelchair usage at all locations.

i. Painting: Materials equal to Coronado, or equal.
   (1) Surfaces: Exterior Doors, Door Frames
      (a) Primer: Applied by Door Manufacturer.
      (b) Finish: 2 coats acrylic latex semi-gloss enamel applied by press box manufacturer.
   (2) Surfaces: Interior Doors
      (a) Primer: Jones Blair Interior Exterior Oil Primer, or equal.
      (b) Finish: 2 coats acrylic latex semi-gloss enamel.
   (3) Surfaces: Exterior Siding
      (a) Primer: Applied by Siding Manufacturer.
      (b) Finish: Applied by Siding Manufacturer.
      (c) Touchup: If applicable
   (4) Surfaces: Wall and Roof Structure
      (a) Primer: Coronado DTM Industrial 180-11 acrylic metal primer applied after welding, or equal.

j. Caulking: Sonneborn NP1 – Polyurethane sealant, All temperature, UV resistant, or equal. Silicone products are not acceptable.

k. Electrical
   (1) Submittal drawing shall indicate devices and circuitry.
   (2) Fixtures: 2x4 Edgelit LED light panels. Fixtures shall be located above countertop and be maximized to full length of compartment space.
   (3) Wiring to be in EMT, flexible metal conduit or surface raceway. N.E.C. breaker panel to be 100 amp flush or surface mounted on wall with 1 1/4 inch conduit stubbed out bottom of press box or 2 inch rigid conduit to be stubbed out at back wall of press box ready for service line to be connected. (Service line to Press Box is responsibility of Owner).
   (4) Electrical outlet(s) installed per NEC shall be standard duty. All outlets shall be surface or flush mounted.
   (5) Sound, Telephone, Clock, Field Communication: Empty single or double outlet boxes (as required) per N.E.C. with 3/4 inch conduit stubbed out bottom of Press Box for use of Owner. Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. Quantity. Two will be provided. Owner shall indicate additional boxes needed.
   (6) Each room to have one Amana PTC 153E35AXXX or equal heat and coolunit.

2.04 WARRANTY

A. The Press Box shall be under warranty for a period of one year beginning at Date of Substantial Completion for projects installed by Manufacturer. The Press Box is warranted to be free from defect in materials and workmanship in the course of manufacture. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond manufacturer's control.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work performed by technicians experienced in bleacher seating installation.

B. Project as per approved shop drawings.

3.02 FIELD QUALITY CONTROL

A. Foundation: Footings for the grandstand shall provide sufficient bearing area at bottom to support all loads of the grandstand. Depth and design of footings shall be determined by Owner supplied soil test. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings. Concrete shall attain working strength of 3,000 psi.

3.03 CLEAN-UP

A. Clean up all debris caused by work of this section.

B. The Owner, Architect and Contractor acknowledge and accept that mill finish aluminum as specified will have water stains present from transportation and storage during installation. Removal of these stains is not part of this contract.

C. Stand to be broom cleaned at completion.

END OF SECTION

DIVISION 14 - CONVEYING EQUIPMENT

14 24 00 HYDRAULIC ELEVATORS

SECTION 14 24 00
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete hydraulic elevator systems.
   1. Passenger type.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Includes elevator machine foundation, enclosed hoistway, elevator pit, divider beams, overhead hoist beams, grouting thresholds, and grouting hoistway entrance frames.

B. Section 04 20 00 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

C. Section 05 12 00 - Structural Steel Framing: Includes hoistway framing, divider beams, and overhead hoist beams.

D. Section 05 50 00 - Metal Fabrications: Includes elevator pit ladder, sill supports, divider beams, and overhead hoist beams.

E. Section 26 05 33.13 - Conduit for Electrical Systems:

F. Section 26 05 83 - Wiring Connections:
   1. Electrical characteristics and wiring connections.
   2. Electrical service to main disconnect location verified by electrical engineer.

G. Section 28 20 00 - Video Surveillance: Installation of video camera in car interior for security monitoring.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).

C. 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 2019, with Errata (2021).

D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters 2020.

E. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors 2018.

F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

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 2021a.

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. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2021).

L. ITS (DIR) - Directory of Listed Products current edition.

M. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

N. NEMA MG 1 - Motors and Generators 2018.

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

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

Q. PS 1 - Structural Plywood 2009 (Revised 2019).

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Clearances and over-travel of car.
   5. Locations in hoistway of traveling cables and connections for car lighting and telephone.
   6. Location and sizes of hoistway and car doors and frames.
   7. Electrical characteristics and connection requirements.
   8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.

E. Testing Agency's Qualification Statement.

F. Initial Maintenance Contract.

G. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

H. Operation and Maintenance Data:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Operation and maintenance manual.
   3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on hoistway apparatus.

1.06 QUALITY ASSURANCE

A. Maintain one copy of each quality standard document on site.

B. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in Utah.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

F. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Hydraulic Elevators: TK Elevators; Endura.

B. Other Acceptable Manufacturers - Hydraulic Elevators:
   1. Otis Elevator Company: www.otis.com/#sle.
   2. Schindler Elevator Corporation: www.schindler.com/#sle.
   3. Kone Inc..

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator:
   1. Hydraulic Elevator Equipment:
      a. Holeless hydraulic with cylinder mounted within hoistway.
   2. Operation Control Type:
      a. Single Automatic Control.
   3. Service Control Type:
      a. Standard service control only.
   4. Interior Car Height: 96 inch (2438 mm).
   5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
   6. Motor Power: 30 hp.
   7. Rated Net Capacity: 3000 pounds (1360 kgs).
   8. Rated Speed: 125 to 150 feet per minute (0.63 to 0.75 m per second).
   9. Hoistway Size: As indicated on drawings.
   10. Interior Car Platform Size: 6'-8" by 4'-9".
   11. Elevator Pit Depth: 48 inch (1219 mm).
   12. Overhead Clearance at Top Floor: 144 inch (3658 mm).
   13. Travel Distance: 15'-4".
   14. Number of Stops: 2 Floors.
   15. Number of Openings: 1 Front.

16. Hydraulic Equipment Location: As indicated on drawings

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70. Refer to Section 26 05 83
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 feet per minute (1 m per second).

B. Electrical Equipment:
   1. Motors: NEMA MG 1.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70. Refer to Sections 26 05 33.13 and 26 05 83.
   3. Include wiring and connections to elevator devices remote from hoistway. Refer to Section 26 05 83.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Conform to ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
   1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
   2. Landing Indicator Panels: Illuminating.
   3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

C. Door Operation Controls:
   1. Program door control to open doors automatically when car arrives at floor landing.
   2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
   3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

2.06 OPERATION CONTROL TYPE

A. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.
   1. Refer to description provided in ASME A17.1.
   2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
   3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
   4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.

2.07 EMERGENCY POWER

A. Set-up elevator operation to run with elevator emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

D. Provide operational control circuitry for adapting the change from normal to emergency power.

E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

A. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.

B. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

C. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

D. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

E. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

F. Resilient Flooring: Vinyl tile flooring, by Owner.

G. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, Main Elevator and Gymnasium Elevator:
   1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
      a. Hoistway Fire Rating: 1 Hour.
      b. Framed Opening Finish and Material: Brushed stainless steel.
      c. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      d. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
      e. Door Operation: Side opening, two speed.
      f. Door Width: 42 inch (1.067 m).
      g. Door Height: 84 inch (2.134 m).
      h. Sills: Extruded aluminum.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car:
   1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above door with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch (1.372 m) above car finished floor.
      d. Provide following within service cabinet as part of car operating panel:
         1) Network data card.
         2) Dedicated network data service line.
   2. Flooring: Resilient vinyl tile.
   3. Front Return Panel: Match material of car door.
   4. Door Wall: Plastic laminate on plywood.
   5. Side Walls: Plastic laminate on plywood.
   6. Rear Wall: Plastic laminate on plywood.

7. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
    a. Round, Metal Tube: 1-1/2 inch (38 mm) diameter.
    b. Stainless Steel Finish: No. 4 Brushed.
8. Ceiling:
    a. Exposed Frame Suspended Ceiling: Plastic laminate on plywood, mount 7 inch (178 mm) below car canopy with 1-1/2 inch (38 mm) nominal space between edge of ceiling and wall.
    b. Frame Finish: Aluminum, brushed finish.
    c. Lighting: Compact fluorescent downlights.

B. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with acrylic plastic, and attached with tamper-proof screws.

2.11 FINISHES

A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.

B. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway and pit are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components, and comply with requirements of Section 01 50 00 - Temporary Facilities and Controls.

B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories. Refer to Sections 26 05 33.13 and 26 05 83.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.
1. Place on structural supports and bearing plates.
2. Securely fasten to building supports.
3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
   1. Schedule tests with agencies and notify Owner and Architect.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
   4. Perform tests required by regulatory agencies.
   5. Furnish test and approval certificates issued by authorities having jurisdiction.

C. Perform testing and inspection in accordance with requirements.
   1. Inspectors shall be certified in accordance with ASME QEI-1.
   2. Perform tests as required by ASME A17.2.
   3. Provide at least two weeks written notice of date and time of tests and inspections.
   4. Supply instruments and execute specific tests.

D. Operational Tests:
   1. Perform operational tests in the presence of Owner and Architect.
   2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
      a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.05 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch (6.4 mm) maximum from flush with sill.

3.06 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, cleaning and maintenance of each component.

E. Training: Train Owner's personnel on cleaning and operation 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 training personnel.
   4. Location: At project site, unless noted otherwise.

3.08 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.09 MAINTENANCE

A. Refer to Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to initial maintenance service.

B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.

C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

D. Include systematic examination, adjustment, and lubrication of elevator equipment.

E. Perform work without removing cars from use during peak traffic periods.

END OF SECTION

DIVISION 21 – FIRE PROTECTION

21 00 00 FIRE PROTECTION

SECTION 21 0000
FIRE PROTECTION

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of the following Sections shall govern the work in Section 21 0000, where applicable, and where not in conflict with governing codes and ordinances.

1. Division 1
2. Section 23 0100 - General Provisions
3. Section 23 0420 - Testing
4. Section 23 0430 - Balancing
5. Section 23 0500 - Basic Materials and Methods

B. Preferred Contractors shall be Kimco Fire Protection, Quality Fire Protection, Fire Engineering Co., Chaparral Fire Protection, Delta Fire Protection Systems, Firetrol Protection Systems, Fire Services Incorporated, State Fire DC, and Paradise Fire Protection.

C. Contractors not listed on the approved list must submit for approval and review prior to bid as required by bid documents

1.2 SCOPE OF WORK

A. The work required includes the designing, hydraulically calculating pipe sizes, flows, and pressure, furnishing and installation of fire protection systems in accordance with the drawings, specifications, latest standards and codes for complete systems for the building.

B. The work specified in this section shall be installed by none other than a recognized fire sprinkler contractor. All fire protection system piping shall be hydraulically calculated. All systems shall be subject to the inspection and approval of the local fire authority or his representative for compliance of applicable standards.

C. All work shall be coordinated with other subcontractors.

D. The sprinkler system shall consist of the required number of sprinkler heads, piping, hangers, drains, test pipes, alarms, valves, gauges, fire department connections, and all other parts to assure a complete system to meet the requirements of the owner's insurance underwriter, local authority having jurisdiction, and in accordance with nationally recognized standards.

E. Codes & Standards:

1. Water Supply: National Fire Code (NFC) #24 - International Building Code (IBC)
2. Wet Sprinkler System & Combined Systems: NFC #13 and #14 -IBC
3. Alarm Equipment: NFC #70 & 72A
4. Standpipe & Hose Systems: NFC #14 - IBC
5. Supervision: NFC #13 and #14 - IBC
6. Temporary Fire Protection: NFC #14 - IBC
7. Sprinkler Heads: NFC #13
8. Sleeves and Location: NFC #13
9. Excavation and Backfill: 23 0500 “Basic Materials & Methods” of this specification.

F. Work Included Elsewhere

1. Underground Mains: International Fire Code (IFC) #24
2. Concrete Work - By General Contractor.
3. Access Doors - By General Contractor.
4. Painting of sprinkler piping - By Painting Contractor.
5. Wiring of flow switches and valve supervisory switches - By Electrical Contractor.

1.3 WORK BY FIRE PROTECTION CONTRACTOR

A. This contractor shall furnish and install all labor, material, and equipment to make a complete and working fire protection system fully tested and approved in accordance with the drawings, standards of this specification for the new building, and minor system modifications in the existing building.

B. Underground Water Supply:

1. Fire protection contractor shall perform a flow test at or near site prior to final calculations for system. Flow test to be performed in the presence of local fire marshal and Owner's representative.
2. Connect fire sprinkler mains to connections provided by others as shown on the drawings and install U.L. labeled pipes into building at locations show. Coordinate testing and flushing of this portion of the main in accordance with NFC #24 and furnish test certificates to the Owner's representative.
3. This contractor will be responsible to coordinate with the site utilities contractor to assure that the underground water supply has been flushed and tested in accordance with NFC #24 prior to the connection of the overhead sprinkler system.

C. Flow Test Information

Flow Chart – See Part 4 of this section.

D. Sprinkler System

1. This system shall conform to IFC #13 and #14 and IBC. Riser may be calculated but shall not be smaller than 6". Sprinkler systems are to be light, ordinary, or extra hazard, as required by NFC #13 and the Utah State Fire Marshall's office.
2. System shall be hydraulically calculated. Sprinkler system shall be light hazard, except for casual ordinary and extra hazard group 1 in storage and service areas. Density of light hazard areas shall be 0.10 gpm per sq. ft. for a 1500 sq. ft. remote area with a maximum head spacing of 225 sq. ft. Service areas shall have a density of 0.15 gpm per sq. ft. over a remote 2000 sq. ft. area with a maximum head spacing of 130 sq. ft.
3. Quick response heads per NFPA 13 are an acceptable alternative.

1.4 QUALIFICATION OF DESIGNER

A. Designer shall be an engineering technician or Senior Engineering Technician (Level III or Level IV), NICET certification for fire sprinkler system design.

1.5 QUALIFICATION OF INSTALLER

A. It is intended that the system be designed and installed by a firm regularly engaged in the design and installation business of Fire Sprinkler contracting. The Owner's representative may require evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor, who cannot verify such experience, may be found not suitable to perform the work.

PART 2 – PRODUCTS

2.1 HANGERS

A. All hangers to be in accordance with NFPA Pamphlet No. 13.

2.2 RISERS

A. Risers shall be at the locations shown and shall include a U.L. approved control valve, check valve, flow switch, pressure gauges, water motor gong, or electric bell, standard fire department connection, gate valve supervisory switch, test connections, and drains as required.

2.3 SPRINKLER HEADS

A. Sprinkler heads shall be U.L. approved. "K" factors shall be the same on each system and/or floor. See plans for head types.

B. Sprinklers shall be of the proper temperature rating. Location of sprinkler head wherever reasonably possible shall be symmetrical and coordinated with the ceiling pattern.

C. Number and location of sprinkler heads shown on the drawings are schematic. Exact number and location of heads shall be determined by the system design, and architectural coordination.

D. Provide dry pendent heads in areas subject to freezing, only where wet piping can be run in heated space. Otherwise, provide antifreeze loops.

E. Provide sparehead cabinets in accordance with NFPA No. 13 and equip same with at least ten (10) chrome heads, six (6) brass heads, and appropriate wrenches.

F. Provide head guards in all areas where heads are subject to physical abuse.

2.4 VALVES

A. All valves and fittings shall be listed by Underwriters Laboratories or approved by Factory Mutual for fire protection duty and shall be installed in accordance with their listing and/or approval. Control valve shall have alarm supervisory switches with two sets of contacts and normally open/normally closed.

B. All indicating valves will be of the listed and/or approved type with an electric tamper switch approved for use with that valve.

C. Water hammer arrestors shall be provided ahead of all automatic valves to eliminate water hammer and shall be installed vertically in an accessible location.

D. Hose valves off standpipes shall be U.L. approved. All valves shall be 2-1/2" with 2-1/2" X 1-1/2" reducer and cap with chains. Valves shall be polished brass and chrome-plated.

2.5 PIPING

A. All piping above ground shall be Schedule 40 domestic steel pipe and fittings.

B. Thinwall, Dyna Flow and foreign made pipe or fittings will not be permitted on this project.

2.6 EARTHQUAKE BRACING

A. Install earthquake bracing in accordance with NFPA #13 Standards and local Fire Marshall's Office.

2.7 SLEEVES

A. Sleeves shall be furnished, together with their location and elevations to the construction manager, timely with required schedule or concrete pours. If sleeves are missed by this contractor, he shall be responsible for core drilling thru concrete at his own expense, and he shall be responsible for his cutting and patching. Sleeves shall be of the size, type, and length required by NFPA codes. See Section 23 0500 for "Sleeves".

B. A 1'-0" gap, or as required by State Fire Marshall shall be provided between the wall and the floor sleeve where the main fire line enters the building.

PART 3 – EXECUTION

3.1 TEMPORARY FIRE PROTECTION DURING COURSE OF CONSTRUCTION

A. This contractor shall provide fire protection as required by NFPA #14 - Chapter 8, and shall be coordinated with the local fire department.

3.2 SHOP DRAWINGS

A. Shop drawings, submittals, and hydraulic calculations, as necessary and required, shall be submitted to the Owner's representative for approval prior to incorporating materials or equipment into the work. Shop drawings shall be complete and in accordance with NFPA #13, #14, #20, and all applicable standards, submittals, and equipment, valves, flow switches, controls, and other important items shall be complete, showing details, description, and characteristics; hydraulic calculations shall show flows, pressures, velocities, pipe size, and equivalent lengths as required for the system.

B. Calculations shall be arranged in an orderly manner with sufficient reference points for the approving authority to review and approve.

C. Testing shall be accomplished by this contractor for all required systems, equipment, and appurtenances, as required by the various standards and codes. The Owner's representative shall witness and sign off each item required. This contractor shall furnish required forms.

3.3 TESTS

A. Install all test pipes and valves as required by NFPA No. 13. Locate inspector's test valves and auxiliary drain valves above ceilings in areas approved by the Architect and provide hose bibb connections. Conduct all tests as required by NFPA Standards and Insurance Services Office and submit copies of completed test forms to the Owner.

B. All fire sprinkler related tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness or documentation, then they will be run late and all damage caused by the system, or caused in uncovering the system for such tests, will be borne by this contractor.

C. The local city Fire Marshall shall be notified (in writing) at least three days in advance of the following:

1. Hydrostatic test and final inspection of the underground piping prior to backfilling.
2. Flushing of underground prior to connection to overhead.
3. Hydrostatic test and final inspection of overhead, prior to the installation of the ceilings.

D. Hydrostatic tests shall be done at a minimum of 200 PSI for 2 hours, or as required by the State Fire Marshall.

3.4 GENERAL REQUIREMENTS

A. This contractor shall submit complete drawings, hydraulic calculations, and proper documentation to the local authority having jurisdiction and receive their approval before submitting such material to the Owner's representative for final approval. The contractor will be required to show proof of submittal to the Owner's insurance underwriter and local building authorities before installation may begin.

B. All work of this contractor will be coordinated with other trades to insure minimal changes to the sprinkler system from the designs. Careful coordination of mechanical and electrical ducts, pipe and conduit shall be required. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict the installation of the mechanical equipment and piping shall be in the following order: plumbing waste, rainwater, and soil lines' supply, return, and exhaust ductwork; water piping; fire protection piping; and pneumatic control piping.

C. Every effort shall be required to insure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, the lights, and diffusers and grilles and as shown on the Architect's reflected ceiling plan. Offsets shall be made in piping to accommodate ductwork in ceiling. Heads should be symmetrical and all piping run parallel or perpendicular to building lines. In no case shall sprinkler heads be installed closer than 6" from ceiling grids or closer than approved distances from ceiling obstructions.

D. All sprinkler piping shall be run concealed unless approved by the Owner's representative. All lines will be run as high as possible so as to not interfere with future changes to ceiling heights or other mechanical equipment. This contractor will be responsible for all sleeves, core drills, and sealing of penetrations in walls, floors, and structural members to facilitate the installation of the system, however, no holes in, or attachments to structural members will be allowed unless approved by the Owner's representative.

E. All required drains and test pipes will be installed and finished in a workmanlike manner, terminating at a proper location to accommodate the required outflow without damaging the building or landscaping. Drain and test pipe locations shall be approved by the owner's representative.

F. All piping and heads located in un-heated spaces shall be installed with a glycol loop system. Coordinate location with the owner's representative. Indicating valves with tamper switches shall be installed and wired as required by code. Coordinate with electrical contractor.

G. No piping or valve assemblies shall be run exposed in a finished area without the prior approval of the owner's representative.

H. All heads located in specialty ceiling systems shall be coordinated with Architect prior to any installation.

3.5 JOB CLOSEOUT

A. This contractor shall assure that all placards, signs, and instruction manuals are in place, and all tests are run before any consideration for final payment will be considered. This includes maintenance manuals, hydraulic calculations placards, spare head cabinets and the proper number of spare heads, and instruction to on-site personnel.

B. This contractor shall, in addition to the above, furnish the owner one (1) set of mylar reproducibles and (1) electronic PDF set, of the sprinkler system "record drawings" for his project files.

PART 4 – FLOW TEST INFORMATION

4.1 SEE REPORT IN THE FOLLOWING PAGES:

WATER SUPPLY ANALYSIS FOR DUCHESNE COUNTY SCHOOL DISTRICT
DUCHESNE HIGH SCHOOL

January 21, 2022

This report contains the results of an analysis of the water supply available for fire protection at the Duchesne County School District, Duchesne High School, at 155 West Main Street in Duchesne, Utah. The Report is prepared at the direction of and under contract to:

John Shepherd
KMA Architects
Project Manager
(801) 377 - 5062
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Prepared By:
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Gardner Engineering
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EXECUTIVE SUMMARY - The results of this Water Supply Analysis are summarized below as required on the Utah State Fire Marshal's Office, Fire and Life Safety Plan Review Submittal Form (the following bolded flow and pressure data comes from page 3 of 4 in this document and is the recommended design data for a fire suppression system at the school, which data reflects the application of a 15% reduction from field test data):

Water Supply Data:

Flow = 1,500 GPM **Static = 50 PSI** **Residual = 47 PSI**

Date of Test = January 4, 2022 **Available Fire Flow at 20 PSI = 5,201 GPM**

INTRODUCTION – Duchesne County School District is looking to do a large remodel and addition to the existing Duchesne High school located at 155 West Main Street in Duchesne, Utah. After completion of the addition, the school building will be approximately 221,000 square feet, Construction Type VB, Occupancy Type E.

Gardner Engineering has been retained to produce a water supply analysis for the subject project. The following is an analysis of the water supply, written with reference to the National Fire Protection Association's 2013 Edition of its Standard for the Installation of Sprinkler Systems (NFPA 13 – 2013).

WATER SYSTEM DESCRIPTION - The portion of the Duchesne culinary water system providing water to the proposed site is gravity-fed and installed in a well-looped grid pattern. Refer to exhibit at the end of this document for a visual representation of the proposed facility, water system layout, and flow test reference points.

According to the Utah State Division of Drinking Water's online records, the City has 2.06 million gallons (MG) of storage and receives its water from two consecutive connections[1]. The System is considered reliable.

FLOW TEST –Please refer to the attached exhibit to see the approximate locations of hydrants and flow test data. The following information is prepared with numbered references to the NFPA 13 – 2013.

23.2.1 Water Supply Capacity Information **(per field test).**

(1) Location and elevation of static and residual test gauge (Residual Hydrant, RH) with relation to the assumed riser reference point in the new structure (RRP): Residual Hydrant is 171 pipe feet west, and at the same elevation as the RRP.
(2) Flow Hydrant (FH): ..... FH is 202 pipe feet east and 2' lower than the RRP
(3) Static Pressure at Residual Hydrant, PSI 59
(4) Residual Pressure at Residual Hydrant, PSI 55
(5) Flow from Flow Hydrant, GPM[2] 1,644
(6) Date ..... January 4, 2022
(7) Time (24 hr clock) 1400
(8) Name of persons who conducted the test ..... Logan Zollinger, (Gardner Engineering)
..... Lane Genereaux (Duchesne City water department)
(9) Other sources of water supply, with pressure or elevation ..... None

ANALYSIS – The following numbered information follows the outline given in NFPA 13 - 2013.

23.3.5.4 Supply Analysis (**per field test**)

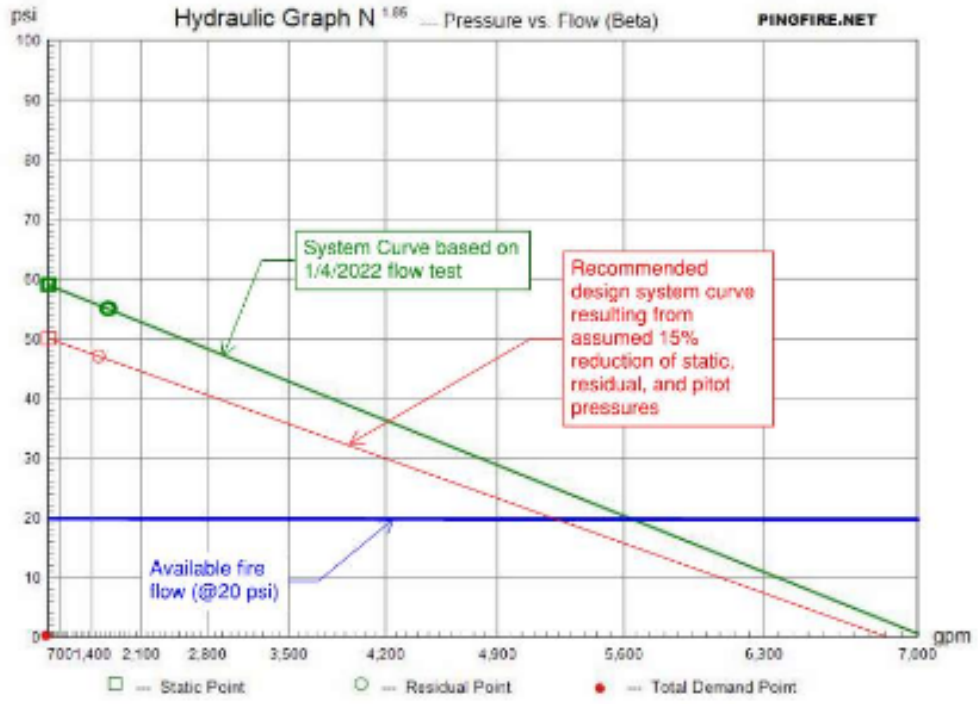
(1) Node tag at the source ..... Residual Hydrant
(2) Static pressure available at the source ..... 59 PSI
(3) Residual pressure available at the source ..... 55 PSI
(4) Total flow available at the source[3] ..... 5,623 GPM

Per A.24.2.2.2 in NFPA13 – 2013, it is recommended that an adjustment be made to the flow test data to "account for daily and seasonal fluctuations…or…other condition that could affect the water supply". Accordingly, the chart below was created to represent both the tested flow (red curve) and a 15% reduction in available pressure in the system (green curve) due to daily and seasonal demand patterns, as well as increased demands as the area builds out. The resulting table of flows and pressures given below this chart show the recommended design flow capacity at the site.

[1] https://waterlink.utah.gov/deqWater/reports.html?systemId=738, accessed 1/6/2022.
[2] Flow listed is calculated using the Q formula: $29.83*cd^2*(p)^{0.5}$; where c=0.9 nozzle coefficient, d=2.5" outlet diameter and p= field measured pitot = 24 PSI; both 2.5" in nozzles were open during the test and a pitot pressure of 24 psi was indicated at 1 flowing nozzle so the assumed total flow is twice the calculated flow at 24 psi: 1,644 GPM.
[3] Total flow available, Q_t, calculated using the equation $Q_t = Q*[(H_r^{0.54}/H_f^{0.54}]$; where: Q = flow (1,644 GPM); H_r = (static pressure (59 PSI) less 20 psi); H_f = (static pressure (59 PSI) less residual pressure (55 PSI)).

23.3.5.3 Graph Sheet

The World's First Web-Based Hydraulic Graph N^1.85 for Water Supply and Demand Information



Project Location: Duchesne High School

FIELD Test: Hydrant Elev.= -2 ft., Static Pressure= 59 psi, Residual Pressure= 55 psi, Flow= 1644 gpm

REDUCED Test: Hydrant Elev.= -2 ft., Static Pressure= 50 psi, Residual Pressure= 47 psi, Flow= 1500 gpm

23.3.5.4 Supply Analysis (**recommended design data**: 15% reduction from flow test)

(1) Node tag at the source ..... Residual Hydrant
(2) Static pressure available at the source ..... 50 PSI
(3) Residual pressure available at the source ..... 47 PSI
(4) Total flow available at the source[4] ..... 5,201 GPM

CONCLUSION

It is our opinion that it is reasonable to assume that a flow of at least 5,201 GPM will be available at the RRP throughout the year into the foreseeable future, absent a major catastrophic system event.

End of Water Supply Analysis (Exhibit follows)

[4] Total flow available, Q_t, calculated using the equation $Q_t = Q^*(H_r^{0.54}/H_f^{0.54})$; where: Q = flow (1,500 GPM – determined from reduced pitot pressure); H_r = (static pressure (50 PSI) less 20 psi); H_f = (static pressure (50 PSI) less residual pressure (47 PSI)).

DUCHESNE COUNTY SCHOOL DISTRICT DUCHESNE HIGH SCHOOL



DIVISION 22 - PLUMBING

22 00 00 PLUMBING REFERENCE

SECTION 22 0000
PLUMBING (REFERENCE ONLY)

GENERAL:

Please refer to section 23 4000 for plumbing.

End of Section

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

23 01 00	GENERAL PROVISIONS
23 05 01	TESTING
23 05 93	BALANCING
23 09 00	BASIC MATERIALS & METHODS
23 18 00	INSULATION
23 40 00	PLUMBING
23 70 00	HEATING/COOLING
23 80 00	AIR DISTRIBUTION

SECTION 23 0100
GENERAL PROVISIONS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The contractor shall carefully read the General Conditions of the Contract and all information to bidders which are part of the Contract. This includes the following specifications.

1. Fire Protection
2. Plumbing
3. Heating/Cooling
4. Testing/Balancing
5. Insulation
6. System Commissioning
7. Basic Materials and Methods
8. Air Distribution
9. Building Automation System (BAS) also referred to at Automatic Temperature Controls (ATC)

1.2 BASIC BID

A. Shall include all labor and materials specified in this division. The term "furnish" and/or "install" or similar implication shall mean "furnish and install complete."

1.3 SCOPE OF WORK

A. The work to be done under this section includes the furnishing of all labor, materials, equipment, controls and accessories required to complete all heating, air conditioning, ventilating, plumbing, drainage, and other mechanical systems as shown on plans and/or described in these specifications, including miscellaneous items required to provide a complete and functional facility.

B. Work shall include, but shall not be necessarily limited to, the following:

1. Fire sprinkler system
2. Assistance with Independent System Commissioning (see 24 0000)
3. Testing
4. Balancing
5. Insulation systems
6. Plumbing system
7. Roof drain systems
8. Air distribution systems
9. Air conditioning systems
10. Hot water heating system
11. Chilled water system
12. Snowmelt systems
13. Exhaust systems

14. Building automation system
15. Special systems

C. The mechanical contractor shall provide all miscellaneous electrical work and control wiring for special systems where the wiring requirements are provided by the equipment manufacturers and/or suppliers, unless all of the required wiring is clearly shown on the electrical drawings to be provided by the electrical contractor.

1.4 CODES AND ORDINANCES

A. All work shall be installed in accordance with the city, state, and local building codes, and all other codes, ordinances, and regulations which govern the type of work covered by these specifications.

B. Should the drawings conflict with the code, the code shall govern the proper installation of the work, and no extra charge shall be made for such change.

C. Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Where the work required by the drawings and specifications exceeds the minimum code requirements, the work shall be done as shown or specified.

E. NOTE: Code compliance, or similar terminology, shall be interpreted to mean "the interpretation of the code as enforced by the local building authority".

1.5 DRAWINGS AND SPECIFICATIONS

A. The specifications are intended to cover all labor, material, and standards of mechanical workmanship to be employed in the work shown on the drawings, called for in these specifications, or reasonably implied by terms of same. The drawings and specifications are intended to supplement one another, and any part of the work that may be mentioned in the one and not represented in the other shall be done the same as if it had been mentioned or represented in both.

B. Large scale drawings shall take precedence over layouts and small scale details.

C. The mechanical drawings are schematic in nature, and show the general arrangement of all piping, mechanical equipment, and appurtenances. They shall be followed as closely as the actual building construction and the work of other trades will permit.

D. Due to tight structural conditions and space limitations in selected areas the contractor should anticipate structural and space conflicts, and shall make allowances for them in his bid. Until the steel fabrication shop drawings are submitted for review, the mechanical coordination cannot be completed.

E. The architectural and structural drawings shall be considered part of the mechanical work insofar as these drawings furnish this Division with information relating to design and construction of the building. Architectural and structural drawings take precedence over the general building layouts and details shown on the mechanical drawings.

F. The structural engineer and architect shall approve all attachments to or modifications of any structural members in the building required for installation of the mechanical systems.

G. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which will actually be required. This contractor shall investigate the structural and finish conditions affecting the work and provide all necessary offsets, fittings, valves, trim, and accessories required to meet actual on-site conditions.

1. Dimensions-

    a. Verify dimensions governing mechanical work at the building. No extra compensation shall be claimed or allowed on account of differences between the actual job-site dimensions and those indicated on the drawings.

2. Adjoining work-

    a. Examine all adjoining work on which the mechanical work is dependent and report any work which must be corrected. No waiver of responsibility shall be claimed or allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 INTERPRETATION OF DRAWINGS AND DOCUMENTS

A. If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the drawings or specifications, he may submit to the Owner's representative, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the proposed documents will be made only by addenda duly issued, and a copy of such addenda will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of the proposed documents. All questions shall be submitted at least seven days in advance of bidding.

B. The Owner's representative will interpret the meaning of any part of the drawings and specifications about which any misunderstanding may arise, and his decisions will be final. Should there appear to be any error or discrepancy in or between the drawings and specification, the contractor shall refer the matter to the Owner's representative for adjustment before proceeding with the work. Should the contractor proceed with the work without so referring the matter, he does so on his own responsibility.

1.7 WORKMANSHIP

A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative.

1.8 SUBSTITUTIONS

A. See Special Conditions pertaining to Substitutions.

B. Requests for prior approval must be submitted to owner's representative a minimum of five working days prior to bid date.

1.9 FEES & PERMITS

A. This contractor shall obtain all necessary permits. The building owner shall pay all fees required in connection with the work.

B. Requirements of the local utility companies shall apply at the time of bidding. Contractor shall have checked with the local utility companies, and shall determine from them all valves, boxes, meter boxes, and meters that will be required to be installed, and shall figure cost of same in his bid.

1.10 SITE INSPECTION AND EXAMINATION OF DRAWINGS

A. The contractor shall carefully study all drawings and specifications pertaining to the work. If any of the work as laid out, indicated, or specified is contrary to or conflicts with any governing ordinances or regulations, the same shall be reported to the Owner's representative before submitting a bid. The Owner's representative will then issue instructions as to procedure.

B. The contractor shall carefully examine the building site and compare the drawings with existing conditions. By the act of submitting a bid, the contractor shall be deemed to have made such examination, to have accepted such conditions, and to have made allowance therefore in preparing his bid.

1.11 VERIFICATION OF DIMENSIONS

A. Before proceeding with any work, the contractor shall carefully check and verify all dimensions, sizes, etc., and shall assume full responsibility for the rigging and fitting-in of his ductwork, piping, and equipment. Where apparatus and equipment has been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The contractor shall carefully check the drawings to see that the equipment he is required to install will fit into the spaces provided, and will allow for proper maintenance and service of the equipment.

1.12 COORDINATION

A. This contractor shall coordinate his work with other specification divisions and shall provide all necessary specialty items, trim, and incidental 115 volt and 24 volt power and control wiring (which is not shown or specified under other divisions) required to provide a complete functional acceptable system.

B. The Division 23 contractor shall coordinate his work such that all slots and openings through floors, walls, ceilings, and roofs are properly located and shall do any cutting and patching caused by neglecting to do so.

1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as the work proceeds.

2. It is the responsibility of Division 23 to locate these items and see that they are properly installed.

C. The locations of all piping, ducts, apparatus, and equipment indicated on the drawings are approximate only, and shall be changed as required to meet the actual architectural and structural conditions at the job site. All changes shall be approved by the Owner's representative. Any change in work which has not been installed shall be made by the contractor without additional compensation, except changes which are caused by architectural and structural changes which substantially increase the size of any of the mains, or which substantially increase the number of fixtures or length of pipe runs. Any and all changes shall be made only upon approval of a written change order.

1. Right of way - Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.

2. Offsets, transitions, and changes in direction in pipes and ducts shall be made as required to avoid conflicts with building footings and foundations or other buried ducts or utilities, and to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions and changes in direction.

D. It shall be each contractor's responsibility to verify exact location, elevation, and/or route of the various mechanical system components with architectural details and with Owner's representative's personnel on job.

E. Where deviations from locations and/or arrangements described are necessary to meet actual job conditions, the changes shall be made without cost to the Owner.

F. The Owner's representative reserves the right to make any reasonable change in location of any outlet, piping, or equipment, before installation, without additional cost.

1.13 LOCATION OF CEILING OUTLETS

A. This contractor shall assist the Owner's representative, General Contractor, Electrical Contractor and other interested parties in the establishment of room centerlines, axis of rooms and all walls.

B. All grilles, registers, ceiling diffusers, etc. shall be located with reference to these established data points.

C. These outlets shall be referenced to such features as room centerlines, walls and ceiling furrings, balanced border widths, etc.

D. Outlets in acoustical tiles, panels, etc. shall occur in joints or centers of whole pieces, etc.

E. The final determination of the exact location of all outlets shall be subject to the direction and approval of the Owner's representative.

1.14 PROVISIONS FOR REMOVAL & ADEQUATE CLEARANCE

A. Install Mechanical work to permit removal of heating and cooling coils, filters, belt guards, sheaves, drives, and other parts requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.

B. Arrange pipes, ducts, and equipment to permit ready access to filters, valves, cocks, traps, starters, motors, control components, and to clear the openings of swinging doors and access panels.

1.15 RECORD DRAWINGS

A. The contractor shall maintain one set of record drawings. These prints shall show the location, elevations and details of all items of work installed under this contract. Buried piping shall be located by dimensions from foundation walls and depths of bury shall be indicated. These shall be marked in red. The completed set of record drawings must be submitted to the Owner's representative before the contractor is eligible to receive the final payment. An up-to-date record set of drawings shall be maintained during the progress of the project, and be available to the Owner's representative upon request.

1.16 COODINATION DRAWINGS

A. The contractor shall provide coordination drawings, when requested by the Owner's representative, to insure that the various mechanical system components are coordinated with each other, and with other building systems.

B. The coordination drawings shall be drawn to scale (usually 1/4" = 1'-0") and shall show all systems as they relate to each other, especially in areas of potential conflict.

C. Equipment room coordination drawings shall include, in addition to the information specified, the size and location of all piping, pipe fittings, valves, strainers, specialties, flexible connections, water treatment devices, control panels, etc., and their installed elevation.

D. Equipment room coordination drawings shall show the location of all pertinent electrical outlets, lights, panels, transformers and switch gear, and their required clearances from duct, piping, and equipment, and for maintenance access.

E. Footing and foundation coordination drawings shall be prepared showing the exact location, depth, and slope of all buried piping to be installed. These coordination drawings shall include all sand and grease interceptors, drains in depressed slab areas, and all necessary buried water piping.

F. This set of foundation coordination drawings shall be maintained in the construction trailer and shall be marked up daily to indicate exact location and elevation of all buried piping and conduit systems.

G. Coordination drawings shall be professionally drafted and shall be clear and concise in their presentation and clarity.

H. All coordination drawings shall be prepared in digital format using professional software such as Revit or AutoCAD. Material shall be submitted in both printed and CD form. Electronic copies must include a PDF set.

I. All ductwork and piping attachments to the building structure shall be detailed, and shall be coordinated with the Owner's representative.

1.17 COOPERATION WITH OTHERS

A. The contractor shall so organize the work that progress will harmonize with the work of all trades, so that all work may proceed as expeditiously as possible. The contractor shall be held responsible for any delays which might be caused by his negligence or failure to cooperate with other contractors or crafts.

1.18 FOREMAN

A. A full-time foreman shall be designated by the contractor to the Owner's representative and shall be available on site for consultation. This individual, when appointed, will not be replaced without prior approval from the Owner's representative. The foreman shall be responsible for the coordination and correct placing of the work.

1.19 GUARANTEE

A. By the acceptance of the contract award for the work herein described, the contractor assumes the full responsibility imposed by the guarantee as set forth herein and should protect himself through proper guarantee from equipment and specialty manufacturers and subcontractors as their interests may appear.

B. All materials and equipment provided and installed under this division of the specifications shall be guaranteed for a period of one (1) year from the date of substantial completion and acceptance by the Owner, unless specifically noted elsewhere in the specification. Should any trouble develop during this period due to defective materials or workmanship, the contractor agrees to correct the trouble without any cost to the Owner, any defect noticed at the time of installation and/or during the guarantee period shall be corrected immediately to the satisfaction of the Owner.

1.20 SCHEDULES,MATERIALS AND EQUIPMENT

A. Approved Manufacturers:

1. Naming of a manufacturer or product does not mean the manufacturer or product automatically complies with the design documents. Submittals must meet all design criteria and shall be acceptable in all respects to the project design team.

B. As soon as practicable, and within 30 days after date of award of contract, and before commencement of work, a complete schedule of equipment and materials proposed for installation shall be submitted to the Owner's representative. The schedule shall include catalogs, cuts, drawings, and such other descriptive data or samples that are requested by the Owner's representative. Schedules shall include all items of equipment used. No partial submittals will be accepted.

C. Provide size (6) corrected copies of each required shop drawing or similar submittal to the Owner's representative for review, approval, and return of two (2) copies. DO NOT SUBMIT without general contractor's signed stamp, indicating the general contractor has reviewed the submittal for completeness and conformance to the Contract Documents.

D. Inform the Owner's representative by notation, or in the letter of transmittal, of any proposed deviation from the requirements of the Contract Documents.

E. Provide required shop drawings or other submittals within time stipulated on approved progress schedule.

F. Do not commence work requiring a shop drawing or other submittal until approval of the required submittal has been received. Such approval will be based upon a review only for conformance with the design concept of the project and with the information given in the Contract Documents, and does not relieve the contractor from responsibility for errors or omissions in the shop drawings.

G. Schedules shall be neatly bound in hard-backed 3-ringed binders. Schedules shall be completely indexed, and shall include the following items:

1. Boilers
2. Heating coils
3. Chillers
4. Cooling coils
5. Pumps and circulators
6. Fan coil units
7. Valves
8. Hot water & chilled water specialties
9. Flow meters
10. Water heaters
11. Piping systems
12. Pipe supports & restraints
13. Custom air handlers
14. Baseboard and finned tube radiation
15. Unit heaters
16. Pressure gauges & thermometers
17. Plumbing fixtures
18. Supply air fans
19. Exhaust air fans
20. Ventilation air fans
21. Filter banks
22. Dampers
23. Louvers
24. Roof hoods
25. Hoods
26. Packaged HVAC rooftop units
27. Medium pressure ducts
28. Medium pressure fittings
29. Medium pressure flexible ducts
30. VAV reheat boxes
31. Low pressure flexible ducts
32. Grilles & registers
33. Diffusers
34. PRV stations
35. Water softeners
36. Insulation systems
37. Vibration isolators
38. Seismic restraints
39. Automatic temperature controls
40. Air balance contractor qualifications
41. System commissioning coordination
42. Fire safing system with installation diagrams
43. Air compressors
44. Other scheduled items

H. Submittals received which do not contain all of the above items will be returned unchecked.

I. Purpose and Contractor's Responsibility: The purpose of the final submittal is to "assist the contractor selecting the equipment." The contractor shall review the submittals prior to submission to the Owner's representative to make sure that the submittals are complete in all details including the following items:

1. Manufacturer's names shall be mentioned in specifications as accepted by Owner at time of bidding.
2. Equipment dimensions shall be verified to fit the spaces provided with sufficient clearances, as may be required by the equipment or indicated on the drawings.
3. Equipment shall be reviewed with respect to schedules, specifications, plans and details.
4. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.

J. Review:

1. Review and acceptance of submittal does not relieve the contractor of his responsibility to fulfill the contract requirements. Review and acceptance of the submittal will not be used as a means of changing the contract requirements. Items not covered in the accepted submittal, or items incorrectly covered but not recognized or identified, shall not be used when contrary to the requirements of the contract documents.

K. Acceptance of Substitute Equipment:

1. If the proposed installation is approved, this contractor shall make all incidental changes in piping, ductwork, supports, installation, wiring, heaters, panel boards, and as otherwise necessary. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for the proper operation of the system resulting from the contractor's selection of alternate equipment, including all required changes in the effected trades.

L. Owner's Refusal Right:

1. In the event that items submitted are substitutions for specified items and are found to be not acceptable, the right shall be reserved to require the specified items.

1.21 OPERATING INSTRUCTIONS AND CATALOG INFORMATION

A. This prime Division 23 contractor shall compile in 3-ringed binders, catalogs of every product used by him and subcontractors in the completion of the work. The binders shall also include copies of the following:

1. Test data (Section 23 0420)
2. Balancing reports (Section 23 0430)
3. System commissioning data (Section 24 0000).

B. Before final acceptance by the Owner's representative, he shall turn over to the Owner this compilation of catalog data. A double index shall be provided, one giving an alphabetical list of product for which catalogs are included, and one giving their addresses, whose products are included in the work. Provide data for each item of equipment listed in SCHEDULES, MATERIALS & EQUIPMENT, as shown in Section 23 0100. Provide a copy of the submittal data. Four (4) copies shall be delivered to the Owner's representative for his approval.

C. Provide warranty schedule and schedule of overload protection as required in Section 24 0000.

D. Manuals not in compliance will not be reviewed and will be rejected.

E. Binders shall be white vinyl with see-thru front and end panels identified as follows, the CD or flash drives shall be identified in a similar manner.

DUCHESNE SCHOOL DISTRICT

DUCHESNE HIGH SCHOOL

OPERATING & MAINTENANCE MANUAL

2022-2023

SET #

PART 2 – PRODUCTS

2.1 MATERIALS, EQUIPMENT, AND ACCESSORIES

A. Unless otherwise specified, all equipment, accessories, and materials shall be new and undamaged, and the workmanship shall be of the best quality for the use intended and shall be acceptable to the Owner's Representative.

B. Equipment, accessories, and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.

C. Should mechanical equipment other than that used in the design be furnished, it shall be the responsibility of the mechanical subcontractor to provide large scale (1/2" = 1'-0") installation drawings, as required, showing service and maintenance points with proper clearance allowances for service.

D. All equipment shall be selected to deliver full rated capacity at the job site elevation.

PART 3 – EXECUTION

3.1 FUNCTIONING AND OPERATION OF EQUIPMENT

A. Contractor's Responsibility

1. Installation and startup shall be so made that its several component parts will function together as a workable system, and shall be left with all equipment properly adjusted and in working order.

B. All Division 23 equipment shall be started by a factory trained and authorized technician. Start up for all equipment shall be witnessed by owner and commissioning agent.

3.2 CLEANING AND PATCHING BY MECHANICAL CONTRACTOR

A. The contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

3.3 INSTRUCTIONS TO OWNER"S REPRESENTATIVES

A. The mechanical contractor shall provide, without expense to the Owner, competent instructors to train the Owner's representatives in the care, adjustment, maintenance, and operation of all parts on the following systems and equipment:

1. Heating
2. Air conditioning

3. Ventilating
4. Plumbing
5. Building Automation System (Automatic Temperature Controls)

B. Training shall be a minimum of 40 hours with no less than 16 hours for ATC training.

C. An additional 40 hours shall be provided by all mechanical sub-contractors to walk thru building with building Owner representative to verify operation of all Division 23 items and control sequencing.

D. An additional 12 hours of training shall be provided to the owner at the time of the 12-month warranty inspection.

E. All training sessions for all divisions shall be professionally videoed, with notations as required for owner reference as to specific equipment.

F. Instruction date shall be scheduled at the time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Owner's representative.

G. No training shall begin until system commissioning is complete and accepted by the owner.

3.4 PROTECTION AGAINST THE ELEMENTS

A. The contractor shall, at all times, take reasonable and adequate precautions to protect his work and all stored materials and equipment from damage by the elements, including flooding, windstorms, etc. and shall not expose the work of any other contractor to such damage.

B. In addition to requirements specified in Division 1, stored material shall be readily accessible for inspection by the Owner's representative until installed.

C. All items subject moisture damage, such as controls, shall be stored in dry, heated spaces.

D. Protect all bearings during installation, and thoroughly grease steel shafts to prevent corrosion.

3.5 REMOVAL OF DEBRIS, ETC.

A. Upon completion of this division of the work, remove all surplus material and rubbish resulting from the work, and leave the premises in a clean and orderly condition.

3.6 PROVISION OF MOTORS, STARTERS, & VFDs.

A. This contractor shall furnish all motors required and necessary to operate equipment furnished by him. The voltage, phase, and horsepower of each motor shall be coordinated with the electrical contractor prior to ordering.

B. This contractor shall furnish all starters or VFDs for all equipment provided by division 23 with motors requiring starters or VFDs. Equipment that is packaged shall have factory provided starters or VFDs.

3.7 OPENINGS FOR MECHANICAL SYSTEMS

A. All openings required for installation of mechanical systems shall be provided by the mechanical contractor. Any piece of equipment which is to be installed in any space of the building and which is too large to permit access through stairways, doorways or shafts shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed. Materials shall be delivered at such stages of the work as will expedite the work as a whole.

3.8 SAFETY REGULATION

A. The contractor shall comply with all local and OSHA safety requirements in performance with this work. (See General Conditions). This contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

3.9 OWNER FURNISHED EQUIPMENT

A. This contractor shall include in his bid the necessary labor and material to properly coordinate and install the required piping, trim, specialties, controls, ductwork, and other necessary utilities and services to equipment furnished by the Owner.

B. This contractor shall relocate (where noted), rough-in and make final connections to owner furnished equipment.

C. See bid documents for a list of owner furnished equipment which is not otherwise identified on the mechanical drawings or in the mechanical division of the specifications.

SECTION 23 0420
TESTING

PART-1 GENERAL

1.1 DESCRIPTION

A. The work outlined in this section shall be performed by the several trades involved.

B. The mechanical contractor shall provide all supervision, labor, materials, tools, scaffolding, and equipment required to complete all system testing.

C. The mechanical contractor shall remove and repair any defective component as indicated by the system tests and retest.

D. The mechanical contractor shall test the operation of all safety and high limit controls to insure proper installation and operation. Any defective devices shall be replaced.

1.2 TESTS AND ADJUSTMENTS

A. Before any piping is covered, tests shall be made in the presence of the Owner's Representative, and any leaks or defective work corrected. No caulking of threaded work will be permitted.

B. Before application of insulation covering, and as far as practical before concealing any piping, all piping shall be hydrostatically tested and proved tight.

C. Stubs shall be capped and all control valves shall be removed during the test.

D. System may be tested in sections, providing connections to last section tested are included in each succeeding test.

E. Following minimum pressures shall be used for testing:

1. Natural gas piping at 150 psig for six hours.
2. Domestic cold water piping at 150 psig for six hours.
3. Domestic hot water piping at 150 psig for six hours.
4. Domestic hot re-circulating water piping at 150 psig for six hours.
5. Plumbing waste and vent piping at 10 ft. head for six hours.
6. Rainwater piping at 10 ft. head for 30 minutes.
7. Heating/Chilled water system piping at 150 psig for six hours.
8. Refrigerant piping as required per ASME B31.5..
9. Duct systems per SMACNA standards.
10. Snowmelt system piping at 150 psig for six hours.
11. Grease ducts shall be tested with light and capture/contaminate. Testing shall be done in accordance to Section 506 of the 2018 IMC.
12. Compressed air piping at 150 psig for six hours.

F. All valves and equipment which may be damaged shall not be subjected to the test pressure.

PART-2 PRODUCTS

2.1 EQUIPMENT

A. The contractor shall furnish all necessary gauges, plugs, test fans, pumps, etc., as required to conduct the tests.

2.2 REPORTS

A. The contractor shall give the Owner's Representative on week notice prior to performing the tests. All tests shall be recorded and copies of reports bound in the O & M manuals and given to the Owner.

PART-3 EXECUTION

3.1 PROCEDURE

A. The contractor shall be responsible to conduct all tests in a safe manner, protecting the work of other trades from water or physical damage.

B. The tests, as indicated, shall be in addition to any test, as required, by any governing agency. Submit all approved tests, as required, by any governing agency to the Owner's representative.

C. Each test and any necessary repairs and retest shall be performed by the contractor which installed the system.

D. Upon completion, a test shall demonstrate that:

1. Piping is not leaking.
2. Ductwork leaks are within the testing tolerances.
3. Culinary hot water system is circulating.
4. All traps are properly vented.
5. There is an ample supply of hot and cold water to fixtures.
6. No fixture or equipment can be back siphoned.
7. There are no back-flow connections.

SECTION 23 0430
BALANCING

PART-1 GENERAL

1.1 SCOPE OF WORK

A. The mechanical contractor shall employ an independent technical firm to perform the checking, adjusting, and balancing (CAB) of the HVAC systems. This firm shall be one whose operations are limited to the field of professional CAB, and this firm shall meet the following qualifications:

1. The firm shall be a member of AABC and/or NEBB.
2. The firm shall be one which is organized to provide professional services of this specific type.
3. The firm shall have completed projects of similar scope within the past 12 months and shall be capable of performing the services specified at the location of the facility described within the time frame specified, and following up the basic work as may be required.
4. All personnel used on the job site shall be engineering technicians, who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to the start of the work for this project.

B. Approved Contractors shall be Certified Test & Balance, BTC Services, RSAnalysis, Bonneville Test & Balance, and Independent Test & Balance.

C. As part of this contract, this contractor shall make all changes in the sheaves, belts, and dampers, including the addition of dampers required for correct balance as required by the CAB firm, at no additional cost to the Owner.

D. The mechanical contractor shall provide and coordinate services of qualified, responsible subcontractors, supplies, and personnel as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting, and balancing period.

E. In order that all systems may be properly checked, balanced, and adjusted as required by these specifications, the mechanical contractor shall operate said systems at his expense for the length of the time necessary to properly verify their completion and readiness for the CAB and shall further pay all costs of operation during the CAB period.

F. The project completion schedule shall be coordinated with the CAB work to provide sufficient times to permit the completion of CAB services prior to Owner occupancy.

1.2 DOCUMENTS

A. The Owner's representative will furnish, without charge to the CAB firm, one set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of plans less the structural sheets.
2. One set of mechanical floor plans of the conditioned spaces.

B. The plans and specifications shall be in electronic PDF format.

C. Approved submittal data on equipment installed to accomplish the test procedures outlined in paragraph "Services of the CAB Firm" of this specification will be provided by the mechanical contractor.

D. The Owner's representative will transmit one copy of the following "Records for Owner" to the CAB firm for review and comments:

1. Record drawings
2. Approved fixture brochures, wiring diagrams, and control diagrams.
3. Shop drawings
4. Instructions
5. Motor and valve charts
6. Operating and Maintenance Manuals.

1.3 SERVICES OF MECHANICAL CONTRACTOR

A. The mechanical contractor shall have all systems complete, calibrated, and in operational readiness prior to notifying the CAB firm that the project is ready for their services. The mechanical contractor shall certify in writing to the Owner's representative that the system is complete and ready to balance.

1.4 SERVICES OF THE CAB FIRM

A. The technical CAB firm shall submit biographical data on the individual proposed to directly supervise the CAB work. It shall also submit their record of specialized experience in the field of air and hydronic system balancing.

B. Act as liaison between the Owner's representative and contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses. The inspection will cover only those parts of the systems relating to the checking and balancing.

C. To check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building.

D. Prepare and submit to the Owner's representative, complete reports on the balance and operations of the systems.

E. The CAB firm shall be responsible for inspecting, adjust, balancing, and logging the data on the performance of the following general systems, including all components.

1. Heating water systems, including pumps, rooftop units, cabinet heaters, coils, controls, etc.
2. Chilled water systems, including pumps, rooftop units, coils, controls, etc.
3. Exhaust and ventilation systems.
4. Freon compressor systems, including chillers, coils, rooftop units, controls, etc.
5. Make-up air systems.
6. Temperature control system in its entirety, includes the verification of all control sequences and safety devices.
7. Type I grease ducts per 2018 IMC 507.6 and 506.3.2.5.
8. Domestic hot water re-circulating systems.
9. Snow melt systems.

F. Before any adjustments are made to the Air distribution systems, the air systems are to be check for such items as dirty filters, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc.

G. Before any adjustments are made to water systems, the strainers shall be cleaned, temperature control valve operation shall be checked, pump rotation shall be checked, pressure reducing valves shall be adjusted, etc.

H. It shall be the responsibility of the CAB personnel to check, adjust, and balance the components of the various systems as listed above using an applicable "proportionate balance procedure" in order that each of them will operate under optimum noise, temperature and air flow conditions in the conditioned spaces in the building "while simultaneously operating at the most energy efficient condition".

I. During the balancing process, if abnormalities or malfunctions of equipment or components are discovered by the CAB personnel, the owner's representative shall be advised promptly so that the condition may be corrected by the project contractor. Data from malfunctioning equipment or components shall not be recorded in the final CAB report.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND INSTRUMENTS

A. This contractor shall provide all necessary labor, equipment, scaffolding, instruments, and materials required to adjust, balance, and check all systems.

PART 3 – EXECUTION

3.1 REPORT

A. The activities, as described hereinbefore, will culminate in a report to be provided to the Owner's representative. This report shall be furnished in six (6) copies. One copy shall be bound in each O & M manual, and one copy shall be included on the CD-ROM presented to the Owner's representative. The intent of the final report is to provide a reference of actual operating conditions for the building operating personnel.

B. The CAB report shall include the following as a minimum:

1. **Preface:** A general discussion of the systems, any idiosyncrasies, any problems encountered, an outline of normal sequence of operation for the HVAC system cycles, any uncorrected noise problem.

2. **Pitot Tube Traverses:** For use in future trouble-shooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.

3. **Temperature Tabulation:** Of all conditioned spaces on a room-by-room basis, a total of at least three readings will be taken of each room on successive days. Record outside ambient temperature at two-hour intervals. The total variation in conditioned space temperatures shall not exceed 2 deg. variance from the thermostat settings.

4. **Air Volumes and Velocities:** As measured at each supply grille, return air grille, and exhaust air grille or air handling device. In all fan systems, the air quantities indicated on the plans may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the contractor to furnish or revise fan drive and/or motors, if necessary, without cost to the Owner, to attain the specified air volumes.
5. **Air Pressure:** As measured across each supply fan, cooling coil, heating coil, air handling unit filter and exhaust fan. Relate these readings to the particular fan curve in terms of CFM handled at the various static pressures, and their relationship to fan power and fan instability.
6. **Water Temperature:** Shall be taken entering and leaving coils and heat exchangers under maximum load conditions in each case.
7. **Water Pressure:** At all gauge connections, pressure readings at coils and pumps shall be related to coil and pump curves in terms of gpm handled and confirmed by gpm flow thru Venturi units at each air handler. The flow of water thru all water coils shall be adjusted by manipulating valves until the rated pressure drop across each coil is obtained and total water flow is verified by Venturi readings. On those with 3-way valves, rated pressure drop shall first be adjusted thru the coils in each of the several systems and the temperature differential between inlet and outlet shall be determined to be in each of the several systems and the temperature differential between inlet and outlet shall be determined to be in accordance with its rating. The bypass valves shall then be adjusted on each coil until an equal pressure drop between supply and return connections is obtained with the three-way valves set to bypass all coils in each of the several systems.
8. **Electrical Current/Voltage:** Measurements to be taken at the drive motor on each piece of equipment.
9. **Fan Speeds:** To be measured in RPM.
10. **Pump Speeds:** To be measured in RPM.
11. **Instrument List:** A list of instruments by type and make used in gathering the CAB data.
12. **Drawings:** The CAB contractor's working drawings shall have the VAV boxes, supply air and exhaust air openings numbered and/or lettered to correspond to the numbers and letters used on the report data sheets so that data in the report can be correlated with each specific supply or exhaust air opening in the building. If room numbers actually used in the building differ from those on the plans, the building room numbers shall be marked on these plans. Only one such marked-up set of drawings need be provided with the six copies of the CAB report.

C. Before final acceptance of the CAB report, the report data, at the discretion of the Owner's representative, shall be verified one time on the job site, by selection of check points (not to exceed 10 percent of total) at random, in the presence of the Owner's representative. Representatives of the testing firm doing the work shall be present and provide the necessary equipment for test data verification.

D. The firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, all dampers in the duct system, all air distribution devices, and flows of freon on water thru all coils, and the power consumption of all motors.

E. During the CAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. The Owner's representative will be advised of any instruments out of calibration so that the controls subcontractor may come in and recalibrate, using data supplied by the balancing firm.

F. Make a total of three inspections within ninety (90) days after occupancy of the building to insure that satisfactory conditions are being maintained throughout and to satisfy and unusual conditions.

G. An additional inspection in the building shall be made by the firm during the season opposite that in which the initial adjustments were made. At that time, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space.

H. At the time opposite season checkout, the Owner's representative shall be given timely notification before any readings or adjustments are made so that they may participate in the checkout.

SECTION 23 0500
BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the basic materials and methods to be used in the following divisions of work.

1. Division 21 Fire Protection

2. Division 23 Mechanical

1.2 MATERIALS & EQUIPMENT

A. All materials shall be new and undamaged. Protect all stored materials and equipment from damage by the elements, including exposure to excessive heat, flooding and rain, windstorms, etc.

B. All materials and equipment shall be installed in strict compliance with the manufacturer's recommendations.

1.3 CUTTING AND PATCHING

A. Any cutting, patching, or filling necessary for the proper execution of this work, except as noted on drawings, shall be done by this contractor.

B. No rough or unsightly work will be allowed. Cutting of structural members shall be done only on approval of the Owner's representative.

C. The attention of the contractor is directed to the requirements of running pipes thru concrete slabs, walls, and beams. These conditions are to be anticipated and sleeves installed as provided for under "Sleeves".

1.4 INSERTS

A. Furnish and set, in all necessary locations, before or during construction, unistrut inserts for use in connection with the support and seismic restraint of piping, ductwork, and equipment furnished under this division of the work.

1.5 SLEEVES

A. Sleeves for Concrete or Masonry Surfaces:

1. For pipes passing thru masonry or concrete construction, provide sleeves at least two pipe sizes larger than the pipe passing thru and made from sections of steel pipe.

2. Provide galvanized iron sleeves with collar on each side of wall for all ducts passing thru masonry or concrete construction.

3. Sleeves shall be placed in structural members only where approved by the Owner's representative.

4. Sleeves through foundation walls below grade shall be mechanical seal type watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

B. Sleeves thru finished Surfaces:

1. For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

C. Sleeves thru Fire-rated Surfaces:

1. All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside, after pipes and/or duct have been placed, with a UL listed fire safety system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact methods(s) to be used.

D. Sleeves thru Sound Rated Surfaces:

1. Pipe or duct sleeves thru sound rated walls or surfaces shall be packed with dense fiberglass. Duct sleeves shall be sealed with duct sealer and fitted with metal cover flanges on both sides.

E. Sleeves thru Floors:

1. Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

F. Provide 22 gauge sheet metal collars on each side of wall for all ducts and passing thru gypsum wall construction or similar construction.

1.6 PIPING & DUCTWORK SUPPORT

A. Steel roof deck shall not be used to support loads from plumbing, HVAC ducts, light fixtures, architectural elements or equipment of any kind, unless specifically noted otherwise. Lightweight suspended acoustical ceilings with a total weight per wire not exceeding 50# may be hung from the steel roof deck. The hangers should be staggered to distribute the load over multiple deck flutes.

B. Bracing of miscellaneous items (mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.

C. Beam clamps shall not be used to hang piping from open web joist, trusses or girders.

D. Use of beam clamps at structural joist systems are not allowed. See detail 0/A123

E. Beam clamps are not allowed for support of piping from joists. Uni-strut supports from top chord of joist is a method of attachment. Coordinate with structural details.

F. All concentrated loads greater than 100 pounds supported by open web steel joists and girders shall be located within 6 inches of joist or girder panel points or the joist or girder shall be reinforced with an additional web member. Refer to the "TYPICAL DETAIL AT ADDITIONAL CONCENTRATED POINT LOAD" in the structural drawings.

G. Concentrated point loads, single or multiple, totaling 100 pounds or less can be located at any point along the top or bottom chord of an open web steel joist or girder between adjacent panel points without meeting the requirements above. A limit of four concentrated 100# maximum point loads per joist or girder will be permitted on spans of 12' or greater, one concentrated 100# max. load on spans less than 12', unless specifically noted otherwise on the structural drawings.

H. Joist bridging shall never be used to support hanging loads.

I. For all attachments to open web steel joists, the attachment to the joist shall equally distribute the load to both chord angles in a manner that does not induce torsion (twist) to the chords. Beam clamps may not be used.

1.7 PIPE LOCATION AND ARRANGEMENT

A. No water supply piping inside the building shall be placed in direct contact with the earth. Buried water piping shall be in gravel a minimum of 4" below the bottom of the floor slab in split tile or PVC pipe sleeve to keep pipe from direct contact with ground.

B. Unless otherwise noted on the drawings, all water piping shall be kept out of concrete floor slabs.

C. Under no circumstances shall plastic piping or ducting materials be run inside of supply or return air plenums.

D. All piping shall be properly racked and supported to run straight and true.

E. All changes in direction shall be made with approved fittings. Pipes shall not be bent to change direction.

F. All piping shall be racked and run to facilitate maintenance work. Under no circumstances shall valves, shock absorbers, drip traps, or piping specialties be installed in a "closed space" without proper access provided for future maintenance. See "Access" section of this specification.

G. NOTE: All piping shall be capped or plugged at the end of each work shift and when not being extended, to prevent the entry of rocks and debris.

H. Any time lines are broken or disconnected, they shall be capped immediately after flushing to remove rock and debris from pipes. If rocks or other foreign materials are found in the system after it has been closed, the contractor shall stand the expense of their removal.

I. All valves, piping, and equipment to be installed so as to permit disassembly for maintenance purposes.

J. Provide drain valves at all low points in piping systems. Run to floor drain where possible, otherwise provide 3/4" hose connection with vacuum breaker.

1.8 VERIFICATION OF INSTALLATION

A. At the time of final inspection contractor shall provide a color CD of all new buried sanitary sewer and storm sewer and all new buried sanitary sewer lines running to grease interceptor, and sampling manhole.

B. Video must be taken after installation is complete to insure that line is installed properly with no low spots, separations, etc. Video shall be performed with water in lines. All areas shall be identified and running linear feet shall be noted. Video shall also insure that all connections have been made properly and that no debris remains in piping system. At any point that debris are noted, debris shall be removed by the contractor and line video re-done for that portion of the line. Building owner shall be notified to witness videotaping.

C. Piping video shall be performed by a source approved by Owner and project engineer.

1.9 PIPE JOINING

A. All steel pipe under 2" in size shall be joined by screwed connections. Heating hot water, chilled water, and snowmelt piping shall be welded if pipe size is over 2" in size.

B. Welded ends shall be plain beveled. Welding fittings must be employed. Small (1-1/2" and smaller) branch connections may be made with Weldolets and Thredolets provided the main is at least 2" dia. and not less than two pipe sizes larger than the branch. Where these connections are used, the pipe opening in the main shall be cut to insure a full inside pipe diameter at the branch connection. Slag and spelter resulting from the hole cutting shall be removed from the main piping.

C. All joints shall be made to maintain the full metal strength of the pipe, with neat and workmanlike appearance.

D. All piping must be perfectly clean before the system is filled.

E. Copper Piping in Domestic Water Service: Piping shall be cut (with a pipe cutter) so ends are square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall be guided with a miter box to insure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.

F. The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished with fine crocus cloth or fitting brushes until all dirt and oxide is removed.

G. A light coat of soldering flux shall be applied to both pipe and fittings. Acid flux shall not be used.

H. Joints in copper pipe shall be uniformly heated to proper soldering temperature to insure that solder will flow to all parts of the joint. The solder shall be fed to the joint until a uniform line of solder appears around the pipe at the end of the fittings.

I. Copper piping used in domestic water service shall be joined with 'Stay-Safe-50' or 'Silvabrite-100' no lead solder.

J. All domestic copper piping 3" and larger shall be brazed.

K. All HVAC copper piping 3" and larger shall be brazed.

L. When valves are being installed in copper piping, the non-metallic parts shall be removed to prevent the heat of soldering from damaging the valves. No heat shall be applied near where an excessive temperature may cause damage.

M. Qualification of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Braziers, and Welding and Brazing Operators."

N. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.

O. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.

P. Welders shall be tested and certified for all positions.

Q. Submit identifying stenciled test coupons made by each operator.

R. Any or all welders may be required to retake welding certification tests without additional expense.

    1. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.

S. Recertification of the welder shall be made after the welder has taken and passed the required tests.

T. Where piping 1-1/2 inches and smaller is to butt or socket welded, submit 3 samples of test welds for approval.

U. PVC pipe joining: Debur and chamfer the end of the pipe removing any ridges or rough edges. If the end is not chamfered, the edge of the pipe may remove the cement from the fitting socket and result in a leaking joint.

    1. Clean and dry the surfaces to be joined.

    2. Test fit the joint and mark the depth of the fitting on the outside of the pipe.

    3. Uniformly apply a liberal coat of primer to inside socket surface of the fitting and the male end of the pipe to the depth of the fitting socket.

    4. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement shall be applied lightly, but uniformly to inside of socket, take care to keep excess cement out of socket. Apply a second coat to the end of the pipe.

    5. Immediately after applying the last coat of cement to the pipe, and while both inside socket surface and the end of the pipe are wet with cement, forcefully insert the end of the pipe into the socket until it bottoms out. Turn the pipe 1/4 turn during assembly (but not after the pipe is fully inserted) to distribute the cement evenly.

    6. Assembly should be completed within 20 seconds after the last application of cement. Hammer blows should not be used when inserting pipe.

    7. After assembly, wipe excess cement from the pipe at the end of the fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate a defective assembly due to insufficient solvent.

    8. Handle joints carefully until completely set.

9. Suspend piping a minimum of every four feet using location hangers.

V. THREADED CONNECTIONS

1. All pipe shall be reamed at the ends and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1.125 times the length of the female thread receiving the pipe. The pipe shall be screwed in the full length of the female thread.

2. Pipe shall be made tight with teflon thread tape or thread lubricant worked into male thread only. Surplus material shall be wiped off and the joint left neat and clean. Lubricant shall be powdered graphite and linseed oil, or plumbage and linseed oil.

1.10 PIPE GRADING

A. Piping shall be uniformly graded in direction of flow as noted below:

Pipe Grading Guide

PIPING	FALL/RISE	DIRECTION	PER/RUN
Rainwater	1"	Down	4'
Water	1"	Up	40'
Waste - 4" & smaller	1"	Down	4'
Waste - 6"	1"	Down	8'
Vent	1"	Up	4'
Condensate Drip	1"	Down	4'
Htg. Water/Glycol	1"	Up	40'
Chilled Water/Glycol	1"	Up	40'
Condenser Water	1"	Up	40'
Snowmelt Water/Glycol	1"	Up	40'
Natural Gas	1"	Down	40'
Compressed Natural Gas	1"	Down	40'
Refrigerant	1"	Down	40'
Compressed Air	1"	Down	40'

1.11 THRUST BLOCKS

A. Plugs, caps, tees, and bends deflecting 22-1/2 degrees or more, either vertically or horizontally, on water lines 6 inches in diameter or larger, shall be provided with thrust blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2-1/2 sand: 5 gravel, and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.

1.12 EQUIPMENT BASES

A. Pumps, tanks and other equipment shown on the plans shall be set on 4" high concrete pads. The pads shall be furnished by General Contractor. The mechanical contractor shall coordinate pad size and location with the general contractor.

B. Roof curbs shall provide a free height from the roof membrane to the top of the curb of at least 12". All roof curbs and platforms shall have a wood nailer strip around the top perimeter for securing the roof membrane and attaching roof flashings. Flashings be by Division 7.

C. Roof curbs shall be attached to building structure as required by the IBC and local codes.

1.13 VIBRATION ISOLATION

A. All mechanical equipment over 5 H.P. shall be isolated in accordance with ASHRAE 2019 Handbook, HVAC Applications, Chapter 49 Noise and Vibration Control, Table 47 "Selection Guide for Vibration Isolation".

B. Care shall be taken by this contractor to prevent the transmission of vibration from equipment to building structure. Flexible connectors shall be installed in all piping connecting to pumps, air handling units, cooling towers, and other flexibly mounted equipment.

C. Flexible connection shall be specifically designed to absorb noise and vibration and to prevent damage to equipment caused by piping stress. Unit construction shall consist of heavy bellows type neoprene rubber hose sections with stainless steel liners and attachments to match piping, or three (3) grooved flexible couplings for grooved pipe systems.

1.14 DEMOLITION

A. Demolition: Provide supervised disconnection, demolition and renovation work as specified in specifications and/or drawings.

B. Damage: Where pipe or equipment to remain is inadvertently damaged or disturbed, cut out and remove damaged section and provide new pipe or equipment of equal capacity and quality.

C. Accessible Work: Exposed pipe to be demolished shall be removed in its entirety.

D. Abandoned Work: Buried pipe abandoned in place, shall be cut out approximately two inches beyond the face of adjacent construction, capped, pumped full of concrete, and the adjacent surface patched to match existing finish.

E. Removal: Equipment specified or indicated to be removed or demolished, shall be removed from the project site.

F. Temporary Disconnection: Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, cleaned, reinstalled, reconnected and made operational.

1.15 SALVAGE RIGHTS

A. The owner's maintenance staff reserves the right to remove system components and equipment scheduled for removal.

PART 2 – PRODUCTS

2.1 PIPING SYSTEMS

A. No foreign made piping, couplings or connectors will be accepted in this construction.

B. All piping shall be in accordance with the American Society for Testing and Materials, ASTM A53 or ASTM F1488.

C. All cast iron pipe and fittings, above ground, shall bear the collective trademark of the Cast Iron Soil Pipe Institute, or have prior approval of the engineer.

D. Water piping to the pressure reducing valve shall be Class 52 ductile iron pipe with mechanical joints.

E. Culinary cold, soft water, hot, and recirculating hot water above grade shall be Type "L" copper with soldered wrought copper fittings. "Pull Tee" or similar systems will not be allowed.

F. The following water piping above grade shall be Schedule 40 black steel pipe. All piping 2-1/2" and larger shall be welded. Threaded fittings shall be used for piping 2” and smaller. Where heating hot water is to be connected to small equipment (piping 1-1/4 inch and smaller), type K copper piping with soldered fittings may be used within 10 feet of the equipment provided a dielectric union is used.

    1. Heating hot water piping

    2. Chilled water piping

    3. Snowmelt water piping

    4. Glycol feed piping

    5. Expansion tank piping

G. Sanitary sewer (waste), grease waste, and roof-drain piping below slabs shall be standard weight DWV schedule 40 solid core PVC ASTM F 1488 piping.

    1. Exception: Grease waste piping shall be cast iron hub and spigot from the floor sink nearest the dishwasher and extend 60 feet downstream. From that point, piping shall be as specified above.

H. Waste, vent, and roof-drain piping above grade shall be standard weight cast iron pipe with no-hub, TY-SEAL, MG, or AB&I 'BEST SET' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".

1. No-Hub couplings: No-hub coupling shall conform to CISPI Standard 310 and shall be listed by NSF international.

2. Compression Gaskets for Hub & Spigot: Compression gaskets shall conform to the requirements of ASTM Standard C564 and ASTM C1563.

3. Joints for pipe fittings shall conform to the manufacturer's installation instructions and local code requirements.

I. Condensate drain lines shall be Type "M" copper with soldered wrought fittings."Pull Tee" or similar systems will not be allowed.

J. Gas lines above grade shall be Schedule 40 black steel pipe. Fittings shall be standard black malleable screwed, or standard welding fittings where welding is required. All gas lines shall be installed in strict compliance with the local fuel supply company requirements. All steel piping located outside building shall be painted per IFGC primer gray with two coats of UV resistant paint.

K. Gas lines below slab will be corrugated stainless steel tube (CSST). All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Piping below slab to be encased in a Schedule 40 PVC pipe with long sweep elbow. Casing to terminate a minimum of 1" above slab. PVC casing to be two pipe sizes larger than carrier pipe but be 2" minimum.

L. Culinary water below slab shall be Type K soft copper. No fittings allowed below slab. Piping below slab to be encased in a Schedule 40 PVC pipe with long elbows. Casing to terminate 1" above slab. PVC casing to be two pipe sizes larger than carrier pipe but be 2" minimum.

M. Refrigeration piping shall be Type "L" copper with malleable copper fittings. Piping shall be specifically treated and sealed for refrigeration systems piping, similar to Mueller.

N. Compressed air shall be type L copper with malleable copper fittings.

O. Water heater condensate drain lines shall be high temperature schedule 40 CPVC pipe with glued fittings.

P. Snowmelt piping outside building and below finished grade to manifold boxes may also be “Ecoflex” pre-insulated and jacketed oxygen barrier PEX piping by Uponor. Piping shall be cross-linked polyethylene tubing with EVOH oxygen barrier with operating pressure of 80 psi at 200°F and a density of 0.0584 lb/ft3. Fittings shall be WiPex brass fittings. Fittings shall be insulated and jacketed to match the pre-insulated piping. Insulation shall be multilayered; closed-cell; PEX-foam insulation with a thermal conductivity of 0.25 BTU in./sq. ft./hour/°F; vapor permeability of 0.1g/100 sq. in./day. Jacket shall be corrugated seamless high-density polyethylene (HDPE); UV-protected. Piping, insulation, and jacket thicknesses shall be per sizes as available from the Uponor “Ecoflex” line.

Q. Snowmelt piping outside building and below finished grade to manifold boxes shall be factory pre-insulated pipe. Internal service (carrier) pipe shall be type K copper, insulation shall be 1.5” thick polyurethane foam (minimum 90% closed cell), and outer jacket shall be 0.10 inch thick fiberglass reinforced polymer (FRP). End seals, gland seals and anchors shall be designed and factory fabricated to prevent the ingress of moisture into the system. Joining shall be per manufacturer’s recommendations. Insulation shall then be poured in place into the field weld area. All field applied insulation shall be placed only in straight sections. Field insulation of fittings shall not be acceptable. The installer shall seal the field joint area with a heat shrinkable adhesive backed wrap or with wrappings of glass reinforcement fully saturated with a catalyzed resin identical in properties to the factory-applied resin. The internal pipe shall be hydrostatically tested to 150 psig or 1½ times the

operating pressure, whichever is greater. Backfilling shall not begin until the heat shrink wrap has cooled or until the FRP lay-up has cured. All insulation and coating materials for making the field joint shall be furnished by the piping system manufacture. Piping shall be capable of up to 250°F fluid temperature. Snowmelt piping shall be Polytherm by Permapipe or prior approved equal.

R. Kitchen indirect waste lines shall be DWV copper with copper drainage fittings.

S. All exposed piping, fittings, valves, and trim in kitchen area shall be chrome plated.

T. Cleanout covers in finished walls shall be chrome finish. Floor covers shall be polished bronze or other, as specified.

2.2 HANGERS AND SUPPORTS

A. Vertical Piping:

1. Attachment - Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and to carry the weight of the pipe and contents. Stacks shall be supported at their bases, and if over two (2) stories in height at each floor by approved metal floor clamps.

2. Cast iron soil pipe shall be supported at not less than each story height and at its base.

3. Threaded iron pipe shall be supported at not less than every other story height.

4. Copper tubing shall be supported at each story for piping one and one half (1 1/2) inches in diameter and at not more than six (6) foot intervals for piping one and one quarter (1 1/4) inches in diameter and smaller. Piping shall be wrapped with three wraps of vinyl tape to isolate pipe from ferrous pipe supports.

B. Horizontal Piping:

1. Under no circumstances shall piping be supported from the metal roof deck.

2. It is essential that all piping be supported from top chord of roof structure at joist panel point locations.

3. It is essential that all piping be supported from top chord of roof structure at joist panel point locations. Coordinate with structural requirements

4. Supports - Horizontal piping shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

5. Cast Iron Soil Pipe - Where joints occur, soil pipe shall be supported at not more than 5-foot intervals, except that where 10-foot pipe lengths are used, supports at 10-foot intervals are acceptable. Supports shall be placed within eighteen (18) inches of the hub or joint. No-hub joints and fittings shall be restrained with rods and clamps per manufacturer's recommendations.

6. Threaded iron pipe shall be supported at approximately 12-foot intervals.

7. Copper tubing shall be supported at approximately 6-foot intervals for piping one and one-half inches and smaller in diameter and at 10-foot intervals for piping two inches and larger in diameter. Piping shall be wrapped with three wraps of vinyl tape to isolate pipe from ferrous pipe supports.

8. Piping placed underground shall be laid on a firm bed for its entire length.

9. Hangers shall be Grinnell FIG 260 Adjustable Clevis Hanger or approved equivalent for both bare and insulted pipe.

10. Where roller type supports are used, they shall be chair type or suspension type, as required. (Provide carbon steel pipe saddles on insulated pipes).

11. Where piping is run adjacent to walls or steel columns, it shall be supported from steel brackets or vertical channel hangers. Brackets shall be PS 732, PS 3282 or approved substitute. Channel systems shall be approved for each condition on an individual basis.

12. Furnish all hangers, inserts, brackets, anchors, guides, sliding supports, etc., and all auxiliary steel necessary for the installation. All supports shall be designed in accordance with the AISC Steel Construction Manual and shall either be galvanized or painted with one shop coat of primer paint.

13. Insulation inserts and shields for cold surface piping will be provided under Section 23 0180 of these specifications.

14. Pipe covering protection saddles shall be installed at all pipe hangers which support insulated "hot surface" piping. Saddles shall be tack welded to the piping and shall match the insulation thickness applied.

15. All copper, fiberglass, or plastic piping shall be securely supported from the building structure at intervals specified and/or recommended by the pipe manufacturer. Non-ferrous piping shall be isolated from contact with ferrous supports with three wraps of vinyl tape.

16. All piping in mechanical equipment rooms shall be supported with vibration control hangers.

17. Plumbers' tape, chain, zip-ties, or wire will not be permitted for pipe support.

2.3 VALVES AND STRAINERS

A. All valves and strainers shall be by one manufacturer. Approved valve manufacturers are Apollo, Grinnell, and NIBCO. Crane and Apollo numbers are used for convenience.

B. Heating, Cooling, Snowmelt, and Domestic Hot and Cold Water:

1. Gate Valves:

a. Valves 2" and smaller shall be Crane No. 422, bronze, screwed, 200 Pressure Class, gate valve with solid wedge disc and rising stem.

b. Valves 2" and smaller without clearance for a rising stem valve shall be Crane No. 426, non-rising stem, screwed, 200 Pressure Class, gate valve with solid wedge disc.

c. Valves 2-1/2" and larger shall be Crane No. 7 1/2E, iron body, bronze trim, flanged OS&Y bronze rising stem, 250 Pressure Class.

d. Valves 2-1/2" and larger without clearance for a rising stem valve shall be Crane No. 3E, iron body, bronze trim, flanged non-rising stem, 250 Pressure Class.

2. Globe Valves:

    a. Valves 1-1/2" and smaller shall be Crane No. 7TF, bronze, screwed, 150 Pressure Class globe valve with a replaceable teflon disc and teflon packing. The disc shall be suitable for hot water up to 360 degrees F. at 150 psi.

3. Check Valves:

    a. Valves 1-1/2" and smaller shall be Crane No. 36, screwed, Y-pattern 200 Pressure Class, swing check Valve.

    b. Valves 2" and larger shall be Crane No. 223 Tilting Disc, Iron body with bronze trimming, flanged, 250 Pressure Class.

4. Butterfly Valves:

    a. Valves 2-1/2" to 16" shall be Crane No. 44 Butterfly valve, lug type, 200 Pressure Class, EPDM seat rated at 275 deg. F, Iron body bronze, disc. Stainless steel stem.

    b. Valves 4" and smaller shall be equipped with the proper size 10 position Multi-lock hand lever, Valves 5" and larger shall be equipped with the proper size Extra Power Manual weather proof gear operator.

5. Ball Valves:

    a. Valves 2" and smaller shall be Crane No. F9202, brass, threaded, 600 WOG. If solder-joint ball valves are desired use Crane No. F9222.

    b. Valves must be suitable for temperature and pressure required in the individual application.

6. Strainers:

    a. Strainers 1-1/2" and smaller shall be Apollo 59LF-000 or approved substitute with bronze body, screwed Y-pattern, 400 CWP/125 SWP, and sediment separators at 20-mesh Stainless Steel screen.

    b. All strainers shall be installed with fine mesh supplementary "construction screens" which shall remain in place while the system is flushed and chemically cleaned. The "construction strainer" basket shall be removed and replaced with the specified strainer just prior to balancing the water systems.

    c. Provide blow-down ball valve on all strainers, they must be the same size as the strainer tapping.

C. Gas Service:

1. Ball Valves:

    a. Valves 3" and smaller shall be Apollo 80, bronze, threaded, 600 CWP, teflon seats, and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by the agency.

2. Pressure Regulators:

    a. Furnish and install approval type gas pressure regulators in gas piping ahead of each appliance and piece of equipment, to which is connected. Regulators located outside the building shall have weatherproof vent with bug-proof screen. Regulators located inside of building shall be vented to the outside thru the roof with weatherproof vent and thread-on bug-proof screen.

2.4 NON-SLAMMING OR SPRING LOADED CHECK VALVES

A. Types: Provide valves of the fully guided or cone-and-diaphragm types.

B. Bodies: Provide flanged or wafer type bodies constructed of cast iron ASTM A 126, Class B; cast steel ASTM A 216/A 216M, Class WCB; stainless steel, Type 304 or cast bronze ASTM B 61.

C. Trim: Seats, disc and springs shall be constructed of 18-8 stainless steel or bronze complying with ASTM B 62. Seats may be of elastomers suitable for 250 degrees F. minimum continuous working temperature or not less than 50 degrees F. above the operating temperature of the system, whichever is higher.

D. Mating Surfaces: Mating surfaces of closure faces shall be bronze or Type 316 or 16-4PH stainless steel or elastomer approved for the particular service and materials must be compatible to prevent electrolytic action.

E. Pressure Loss: Pressure loss through the valves, measured in feet of water, shall not exceed 6/10 of the water velocity in feet per second.

F. Bubble-Tight: Non-slamming and spring loaded check valves shall provide bubble-tight shut-off when handling water up to 250 degrees F. and 125 pounds per square inch differential pressure. Design shall prevent rubbing of seat materials when opening and closing. Poppet valves shall have conical springs.

2.5 GENERAL DUTY VALVES & SPECIALTY COCKS

A. Cocks:

1. Gas cocks 2" and smaller shall be flat head, bronze threaded. For pressures under 1/2 psi shall be ANSI Z21.15/CGA 9.1, pressures under 5 psi shall be ASME B16.44, and pressures under 125 psi shall be ASME B16.33 as described in the 2018 IFGC.

2. Compression Gauge cocks shall be Apollo 26-100, bronze, screwed, or approved equivalent.

3. Pet cocks shall be Apollo 53-300, bronze, screwed with lever handle or approved equivalent.

4. Try cocks shall be Apollo 26-700, 3/8", bronze, screwed, 250# rated with stuffing box, or approved equivalent

5. Provide two complete sets of wrenches for all cocks and stops.

2.6 BACKFLOW PREVENTERS

A. Backflow preventers shall comply with requirements of the International Plumbing Code as to type, style, size, location, and arrangement for the actual installed duty.

B. Where backflow preventers are installed which release water thru the valve to the atmosphere, these units shall be provided with drip pans which collect the free water. The drip pans shall be piped to the nearest drain.

C. All backflow preventers shall be installed with all necessary isolation valves and test cocks.

D. Backflow preventers at service sinks shall be as per detail 0/A123.

2.7 AUTOMATIC VALVES AND WELLS

A. The mechanical subcontractor shall install the automatic temperature valves, temperature sensing wells, and flow switches, as directed by the automatic temperature control subcontractor.

2.8 UNIONS

A. Ground joint unions shall be installed on pipe 2-1/2" and under where indicated on drawings. Whenever piping is connected to a major piece of apparatus, unions shall be provided as near as practical on each side of the apparatus.

2.9 ISOLATION FITTINGS

A. Approved isolation fittings shall be installed at the junction of all copper and steel piping to prevent electrolytic action. Fittings shall be NZR brass unions or fittings. Or Approved Equal

2.10 THERMOMETERS

A. General: Provide liquid-in-glass type thermometers or variable angle digital thermometers as manufactured by Weiss unless bimetal dial type is required due to space limitations or other conditions.

B. Scale and Dial: Provide liquid-in-glass thermometers of the organic liquid type having a nominal scale length of not less than 7 inches. Provide bimetal dial thermometers with a nominal 5-inch dial size graduated through a minimum arc of 270 degrees. Provide a recessed dial so that graduated portion and pointer are in the same place.

C. Range: Temperature range shall be as shown on the drawings or as specified.

1. Chilled water system 20 degrees F. to 120 degrees F.

2. Hot water system 30 degrees F. to 240 degrees F.

3. Condenser water system 30 degrees F. to 240 degrees F.

D. Case: Provide liquid-in-glass type thermometer with an aluminum alloy or steel case. Provide bimetal dial thermometers with all exposed metal parts, including the case and stem made of 300 Series stainless steel, all welded construction.

E. Accuracy and Calibration: Bimetal dial thermometers shall have zero adjustment for recalibration and shall have an accuracy of plus or minus one percent of span through the complete range. Liquid-in-glass thermometers used for indicating shall have an accuracy of plus or minus 0.5 degree F. unless otherwise required in other sections of the specifications, thermometers for commissioning tests shall have an accuracy of plus or minus 0.25 degree F.

F. Thermometers measuring temperature for energy calculations shall have an accuracy of plus or minus 0.1 degree F.

G. Thermometer Wells: Provide pipe line liquid-in-glass thermometers with a union connection, tapered bulb chamber and matching taper on well. Provide bimetal dial thermometers with a well to match bulb chamber. Provide wells for insulated pipe of the extension neck type suitable for insulation thickness. Provide wells fabricated of bronze, brass or 316 stainless steel suitable for the fluid or gas in the pipe.

H. Stem: Provide stems with a minimum length of 2-1/2 inches immersion which shall be increased in length as necessary to reach the center lines of the pipes in which they are installed.

I. Adjustment: Provide straight or angle pattern adjustable type thermometers as required to facilitate readings.

J. Thermometers shall be Palmer, Trerice, Marsh, or Weiss. Install all thermometers so as to be easily readable from the floor.

2.11 PRESSURE GAUGES

A. General: Provide pressure gauges which comply with ANSI B40.1

B. Dials: Provide dials not less than 4-1/2 inches in diameter, except that packaged equipment may be provided with manufacturer's standard gauges of equal accuracy.

C. Ranges: Select operating ranges so that during normal service the gauge pointer will be at the approximate midpoint of the gauge scale.

D. Refrigerant Gauges: Provide refrigerant pressure gauges with corresponding temperature scales for the particular refrigerant sensed.

E. Accuracy: Pressure gauges used for commissioning of other equipment shall have a minimum accuracy of 3 percent of span.

F. Gauge Cocks: All gauges shall be furnished with gauge cocks and pressure snubbers.

G. Gauges shall be Ashcroft, Trerice, U.S. Gauge, MILJOCO, or Weiss.

2.12 PRESSURE & TEMPERATURE TEST PLUGS

A. Plugs shall be brass body type with Neoprene, Nordel, or Vitron self-closing valve (to suit temperatures of fluid in pipe). Test plugs shall be Peterson 311 Series Pete's Plug or approved substitute. Furnish six pressure and six temperature instruments to Owner to permit reading pressures and temperatures.

2.13 FLOW MEASURING AND BALANCING SYSTEMS

A. Furnish and install complete the Venturi and calibrated orifice Flow Metering Systems as shown on the drawings.

B. This shall be a coordinated system with individual Venturi Flow Stations supplied by one manufacturer and each individual calibrated orifice supplied by one manufacturer.

C. On pipe sizes 3/4-inch diameter and smaller, provide calibrated balancing valves on runouts to fan coil units, fin tube radiation, convectors and reheat coils.

D. Fittings shall be of the combination balancing and shut-off type with the balancing device positioned by an Allen set screw or other approved method which permits closing of the valves without disturbing its balanced position.

E. Bodies may be of the globe or "Y" type with contour flow plug or approved equivalent.

F. Provide a graduated dial or other device to indicate the valve setting.

G. Gland shall permit packing under pressure.

H. Materials and construction shall be as specified for water valves sizes 1-1/2-inch and smaller.

I. On sizes 3/4-inch and smaller ends may be sweat or compression type.

J. Each station shall be complete with quick disconnect valves and safety shut-off valves, metal identification tag on chain giving pipe size, meter series, station identification, and meter reading at specified flow rate. Metering stations shall be selected so that design flow rate shall be between 10 and 40 inches of water pressure differential with permanent pressure loss of not more than 25% of indicated flow rate differential pressure.

K. The calibrated flow metering valves shall be selected to deliver the rated flows at the mid-point of their set-point range.

L. A master meter shall be furnished to the owner for maintenance purposes.

M. Venturi Flow Metering System shall be by Barco Engineering Company or Robertson. Calibrated orifice system shall be Bell & Gossett, Armstrong, or Taco. Balancing vales shall be Danfoss, IMI flow design, or approved equal.

2.14 DRIVES (SHEAVES, BELTS, MOTORS, STARTERS, VFDS)

A. V-BELT DRIVES

1. Capacity of V-belt drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.

2. V-belt drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.

3. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bused type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

B. VARIABLE FREQUENCY DRIVES:

1. Drives installed on this project shall be from the same manufacturer. The contractor shall be responsible for verifying the system has specified proper harmonic mitigation for the drives.

2. General VFD requirements:

    a. Drives shall be UL labeled as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR when installed in accordance with the manufacturer's guidelines.

    b. The base drive shall be CE and meet EN (International Electrotechnical Commission) 61800-3 for the First Environment restricted distribution (Category C2).

    c. The base drive shall be seismically certified per 2018 International Building Code (IBC) with a seismic importance factor of 1.5, and minimum 2.5 SDS rating.

    d. The base drive shall be SEMI-F47 certified. The drive must tolerate related voltage sags.

3. The drive package as specified herein and defined on the drive schedule shall be enclosed in a UL Type enclosure. Should the drive be located outdoors, the enclosure shall be NEMA 3.

4. The drive shall provide full rated output from a line of +10% to -15% of nominal voltage across an ambient temperature range of 5 deg F to 104 deg F with 0 to 95% relative humidity non condensing.

5. Drives shall be controlled by one or more Advanced Control Panel (keypad) user interface that is connected to one or more drives.

    a. Plain English text

    b. The control panel shall include at minimum the followings controls:

    c. There shall be a built-in time clock in the control panel with 10-year battery backup.

    d. I/O Summary display with a single screen shall indicate and provide:

    e. The drive shall automatically backup parameters to the control panel. The drive shall allow two additional unique manual backup parameter sets to be stored.

6. All drives shall have the following hardware features/characteristics as standard:

    a. The drive shall include an interface port for use between the drive and a laptop.

    b. At a minimum, the drives shall have internal impedance equivalent to 5% to reduce the harmonics to the power line. 5% impedance may be from dual (positive and negative DC link) chokes, or AC line reactor.

    c. The drive shall have cooling fans.

    d. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute.

    e. The input current rating of the drive shall not be greater than the output current rating.

f. Circuit boards shall be coated per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

g. Coordinated AC transient surge protection system consisting of 4 MOVs (phase-to-phase and phase-to-ground), a capacitor clamp, and internal chokes. The MOVs shall comply with UL 1449 4th Edition.

h. The drive shall include a robust DC bus to provide short term power-loss ride through. An inertia-based ride through function should help maintain the DC bus voltage during power loss events.

7. All drives shall have the following software features as standard:

a. A Fault Logger that stores the last 16 faults in non-volatile memory. The most recent 5 faults save at least 9 data points, including but not limited to: Time/date, frequency, DC bus voltage, motor current, DI status, temperature, and status words.

b. An Event Logger that stores the last 16 warnings or events that occurred, in non-volatile memory. Events shall include, but not limited to: Warning messages, checksum mismatch, run permissive open, start interlock open, and automatic reset of a fault.

c. Programmable start methods: Flying-start, Normal-start, and Brake-on-start.

d. Programmable loss-of-load (broken belt / coupling) indication. This function to include a programmable time delay to eliminate false loss-of-load indications.

e. Motor heating function to prevent condensation build up in the motor. Motor heating adjustment, via parameter, shall be in "Watts."

f. There shall be a run permissive circuit for damper or valve control.

g. Four separate start interlock (safety) inputs shall be provided. The control panel will display the specific safety(s) that are open.

h. The drive shall include a switching frequency control circuit that reduces the switching frequency based on actual drive temperature. It shall be possible to set a minimum and a target switching frequency.

i. The ability to automatically restart after non-critical faults.

j. PID functionality shall be included in the drive.

k. A computer-based software tool shall be available to allow a laptop to program the drive.

l. The drive shall include a fireman's override mode.

8. Security Features

a. The drive manufacture shall clearly define cybersecurity capabilities for their products.

b. The drive shall include password protection against parameter changes. There shall

be multiple levels of password protection including: End User, Service, Advanced, and Override.

c. A checksum feature shall be used to notify the owner of unauthorized parameter changes made to the drive.

d. The "Hand" and "Off" control panel buttons shall have the option to be individually disabled (via parameter).

9. Network Communications

a. The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Communication cards for BACnet/IP and LonWorks shall be installed where applicable. .

b. The drive shall not require a power cycle after communication parameters have been updated.

c. The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later.

10. Disconnect - A circuit breaker or disconnect switch shall be provided. The disconnect shall be door interlocked and padlock-able. Drive input fusing shall be included on all packaged units that include a disconnecting means. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

11. Installation shall be in accordance with national, state and local building and electrical codes.

12. Start-up shall be provided for each drive by an authorized local service provider.

13. Training shall include installation, programming and operation of the drive, bypass and network communications. Owner training shall be provided locally upon request.

14. Variable frequency drives shall be: ABB, Allen Bradley, Mitsubishi, Yaskawa, or approved equal.

C. MAGNETIC STARTERS:

1. Contractor furnishing pre-wired "packaged equipment" with motors above 3/4 HP shall furnish factory-mounted magnetic starters. Magnetic starters shall provide both overload and undervoltage protection and shall have integral hand-off-auto switch, auxiliary contacts, and pilot. All motors installed under this contract shall have a disconnect switch in the immediate vicinity of the motor. Starters on three phase motors shall protect all three legs of the circuit.

2. Starters for all motors on other than "packaged equipment" will be furnished and installed by the electrical contractor.

3. Starters for all motors on other than "packaged equipment" will be furnished under the mechanical section of the work and will be installed by the electrical contractor.

4. Starters shall be two-speed type or explosion-proof type where required.

5. Provide a heater index bound in the mechanical section of the O&M manuals for all starters furnished on the project.

6. Starters to be Cutler-Hammer, Eaton, or Square "D".

D. MOTORS:

1. Motors shall be furnished and installed under the applicable Mechanical Sections of the Specifications.

2. Each motor shall be designed and provided with a nameplate for the electrical characteristics shown on the Drawings or as otherwise noted.

3. Motors shall be constructed and rated to deliver full nameplate capacity at the project altitude.

4. Horsepower shall be at least equal to that shown on the drawings. Where equipment is submitted and approved for the installation which requires larger motor sizes than shown, the wire and start sizes shall be increased and means provided for operation and control suitable for the larger motors with no increase in cost to the Owner.

5. Unless otherwise specified, or required for controller sequencing, all motors over 5 HP shall be premium efficiency type, and all fractional HP single phase motors 1/2 HP & under shall be permanent split capacitor (PSC) type.

6. Premium efficiency motors shall be based on CEE premium efficiency criteria for OPD motors at 1800 RPM.

MINIMUM MOTOR EFFICIENCY TABLE

HORSEPOWER	NEMA PREMIUM EFFICIENCY
5	89.5%
7.5	91.0%
10	91.7%
15	93.0%
20	93.0%
25	93.6%
30	94.1%
40	94.1%
50	94.5%

7. Motors for V-belt drives shall be provided with cast iron or steel base, with slide rail and adjustable screw device and shall be isolated by rubber-in-shear devices.

8. Motors shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed and load which may be obtained by the drive actually furnished.

9. Motors provided with automatic control shall be capable of making as frequent starts as the control device may demand. Motors not provided with automatic control shall be capable of making not less than 4 starts per hour.

10. All belt-connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration of incorrect belt tension.

11. Motors shall be air cooled, and shall be guaranteed to operate continuously at 115% of full load with temperature rise in any part not to exceed 40 degrees C above the ambient air temperature.

12. Motors shall be open drip-proof or totally enclosed fan cooled type as required, and shall be commercially dynamically balanced and tested at the factory before shipment.

13. Motors shall be selected for quiet operation. Sound power levels shall be within NEMA MGI-12.49.

14. Motors shall comply with requirements of ANSI C 50, NEMA MG-1, and all NEMA standards.

15. Motors controlled by variable frequency drives shall have characteristics which are fully compatible with the drives to which they are connected. Provide written confirmation of coordination with VFD supplier.

16. Approved Manufacturers: Dayton, Reliance, and Westinghouse.

2.15 HEATING CABLE

A. Water and Roof Drains

1. Furnish and install complete electrical heating cable on all pipe and fittings which may be exposed to freezing. Heat cable shall be of the self-regulating low temperature type with a heat output of 8 watts/ft. (27 BTUH/ft), and a weather-proof PVC sheath. The heating cable shall automatically adjust heat output to correspond with the heat loss rate. Cable shall be UL and FM approved for use in rainwater downspout ice melting applications, and for freeze Protection on exterior piping systems.

2. Cable system shall be furnished with power termination, end seal kits, splice and tee fittings, and all accessories required for a complete installation.

3. Thermon, Raychem, or prior approved equal.

B. Freezer Unit Condensate Drain

1. Furnish and install complete electrical heating cable on all pipe fittings which may be exposed to freezing. Heat cable shall be of the self-regulating low temperature type with a heat output of 5 watts/ft. (17 BTUH/ft). The heating cable shall automatically adjust heat output to correspond with the heat loss rate. Cable shall be UL and FM approved.

2. Cable system shall be furnished with power termination, end seal kits, splice and tee fittings, and all accessories required for a complete installation.

3. Thermon or prior approved equal.

2.16 SEISMIC RESTRAINTS

A. All Division 23 nonstructural components shall be anchored and seismically restrained as required by the current editions of the International Building Code (IBC), and NFPA 90A for fire protection systems.

B. The Division 23 contractor shall be responsible for supplying and installing equipment vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the delegated seismic submittal.

C. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by a restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment.

D. Shop drawings submitted for seismic bracing and anchors shall bear the Engineer's signed professional seal.

E. The above qualified seismic engineer shall determine specific requirements on equipment anchorage and restraints, locations and sizes based on shop drawings for the mechanical equipment which have been submitted, reviewed and accepted by the Owner's representative for this project.

F. The Division 23 contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed for the equipment shop drawings and certified correct by the equipment manufacturer for the site specific seismic conditions with direct anchorage capability.

G. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.

2. The professional seal of the engineer who is responsible for the design of the vibration and seismic restraint system for isolated equipment.

3. Details for the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.

4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.

5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.

6. The location of all restraints of pipes and ducts with the locations shown on a floor plan noting the size and type of anchorage and restraint to be used.

H. Snubbers:

1. Snubbers shall be double acting and consist of interlocking steel members restrained by replacing shock absorbent elastomeric materials a minimum of 3/4 inch thick.

2. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch nor more than 1/4 inch.

3. A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.

I. Design and installation:

1. General: All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed or supported to withstand seismic disturbances and remain operational. Provide all engineering, labor, materials and equipment for protection against seismic disturbances as specified herein.

2. All equipment not anchored directly to the floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

3. Isolated Equipment: All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases with vibration isolators as described in the vibration control section of

   23 0500, unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.

4. Piping: All isolated and non-isolated piping for project defined with an importance factor (Ip) of 1.0 3-1/2" I.D. and larger shall be protected in all planes to restrain seismic motion; for projects defined with an Ip of 1.5 1-1/4" I.D. and larger shall be protected. Where necessary the piping restraints shall be resiliently attached to the piping with vibration dampening inserts to prevent the transmission of vibration to the building structure. Locations shall be as scheduled and shall include but not be limited to:

   a. At all drops to equipment and at flexible connections.

   b. At all 45 deg. or greater changes in direction of pipe.

   c. At horizontal runs of pipe, not to exceed 30 ft. O.C. spacing.

   d. Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.

5. Piping in mechanical rooms shall have additional seismic restraints as scheduled in the delegated seismic submittal.

6. Non-Isolated Equipment: The restraint systems for all non-isolated equipment are to be installed to resist stresses produced by lateral and vertical forces according to the current edition of ASCE 7 Chapter 13. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

7. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

    a. Mason Industries, Inc.

    b. Korfund

    c. Amber/Booth Company

    d. Vibration Mountings and Control Company

    e. Kinetics Noise Control

8. Manufacture and design of restraints and anchors for internally isolated equipment shall be the responsibility of the manufacturer of the vibration isolators furnished with the equipment.

9. Piping, ductwork, and equipment without moving parts shall be restrained as shown and noted on the drawings. Locations shown are approximate and shall be coordinated with other trades and with the structural engineer at the job site.

J. Field Services

    1. The seismic restraint manufacturer's representative shall conduct a minimum of (2) on-site visits to train and to conduct site observations and shall certify that all restraints have been installed per manufacturer's instructions and applicable codes and standards. A letter of certification shall be provided in O&M manuals and on CD Rom.

K. For special inspections as required by IBC Chapter 17 the owner shall select and contract with a third-party to conduct necessary inspections described therein. Periodic special inspection is required for all the following items installed in structures assigned to seismic design categories C, D, E, and F:

    1. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units.

    2. Installation and anchorage of ductwork designed to carry hazardous material.

    3. Installation and anchorage of vibration isolation systems where the approved construction documents require a nominal clearance of 1/4" or less between the equipment support frame and restraint.

L. The inspector shall follow ACI 318 Chapter 17.8 for installation and inspection of anchors.

2.17 CHEMICAL CLEANING

A. Prior to operating any heating or cooling systems, all piping systems and components shall be chemically cleaned and flushed by an experienced chemical cleaning service approved by the Engineer.

B. Pipe Exterior: Wash and wipe pipe exterior to remove construction dirt, loose scale and flux.

C. Pipe Interior: Flush pipe interior with clean water. Continue flushing until the piping system runs clean. After flushing inspect the following to determine the presence of construction debris. If debris is found, disassemble equipment and remove debris. Reflush the system and re-inspect.

1. strainer screens
2. chiller evaporator
3. piping low points
4. tank drains

D. Do not operate centrifugal pumps until system has been cleaned and flushed.

2.18 GLYCOL FILL AND RECLAIM SYSTEMS

A. Furnish and install the glycol fill systems detailed on the drawings.

B. The fill system shall be complete with translucent polypropylene tank with cover (100 gal for heating hot water and chilled water systems, 55 gallon for snow melt systems). High pressure metering pump with controls, liquid level alarm sensors to sound local alarm on high -or- low tank level and prevent pump operation on low liquid level.

C. Controls shall cycle on feed pump when system pressure falls below low pressure set point and shall cycle off when system pressure exceeds high pressure set point.

D. Provide operating controls with a "summer-winter" selector switch to index system control for all glycol feed units on the following systems:

1. Heating Water
2. Chilled Water
3. Snowmelt Water

E. Provide (1) hand pump to owner for transfer of glycol from drums to tank.

F. Electrical contractor to provide a 110 volt duplex outlet for glycol feed and reclaim systems and a 110 volt duplex outlet for each receptor pump. Control contractor to wire all low voltage wiring. Conduit shall be 3/4" minimum.

G. System shall be Pulsafeeder or approved equivalent.

2.19 GLYCOL

A. This contractor shall furnish all propylene glycol solution for the chilled water and heating hot water (30% volumetric concentration), and snowmelt systems (40% volumetric concentration). Glycol solution shall be colored Dowfrost HD or Jeffcool P-150 HD low toxicity polypropylene with extra strength corrosion inhibitors. Glycol fill tanks are to be full at the end of construction (after the contractor has all air removed from the systems). The contractor shall provide 100 gallons of pre-mixed glycol solution in addition to the pre-mix solution initial fill, for use in maintaining the systems.

B. Contractor shall provide to the Engineer a complete system analysis at the time of final inspection. Analysis shall be included in the building O&M Manuals.

C. Fill water used for mixing glycol shall be de-ionized water, distilled water, or of an approved level of chlorides and sulfates as allowed by Glycol manufacturer. Soft water shall not be used to mix glycol.

D. Glycol suppliers shall be Power Engineering, Alpine Technical Services, WEST Inc., or approved equal.

2.20 GREASING AND OILING

A. Prior to placing the equipment in operation, the bearings on all motors, fans, pumps, etc., shall be properly lubricated with a lubricant suitable for the service.

B. Lubrication instruction tags are to be left on "all" bearings and equipment for the Owner's future use. Only lubricants recommended by the equipment manufacturers shall be used.

C. It shall be incumbent on the contractor to operate the building equipment useed for temporary heat, etc., in a prudent manner to insure that when the building is turned over to the Owner all equipment is in a "first-class" condition.

D. Equipment shall not be operated unless:

1. All safety devices are installed and functioning properly.

2. Filters are in place on fan systems. Filters to be new and clean.

3. Equipment is properly greased and oiled.

4. Belts and drives are properly aligned and adjusted.

E. The contractor shall maintain a current "equipment maintenance" chart in the construction shack at all times. This chart shall be posted in a conspicuous place and shall include all items of maintenance necessary for proper operation of the equipment.

F. Equipment used for temporary heat and cooling shall, if requested by the Contracting officer, have tube bundles pulled by contractor for Owner inspection prior to acceptance.

2.21 VALVE TAGGING

A. All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The contractor shall furnish and install approved brass tags for all designated items, which numbers and letters on the tags corresponding to those on the charts and diagrams. The contractor shall furnish and install approved brass tags for all designated items, which numbers and letters on the tags correspond to those on the charts and diagrams.

B. Brass tags shall be not less than 1-1/2" diameter with depressed black filled numbers not less than 1/2" high and black filled letters not less than 1/4" high. Tags shall be securely fastened to valves with approved brass "S" hooks, or brass jack chain, in a manner to permit easy reading. Zip ties are not acceptable. Do not attach to valve wheel. Brass tags shall be manufactured by Seton Name Plate Company, New Haven, Connecticut, or approved equal.

C. Each valve shall have an identifying number identifying the unit. Standard identifications may be used for identifying type of service or fluid in pipe. The contractor shall submit his system of identification to the Owner's representative for approval prior to ordering. Any work done without this approval is done at the contractor's risk.

D. Charts of all valves shall be furnished to the Owner's representative by the contractor.

E. A chart to be mounted in a frame with clear glass font, and secured on the wall in the main Mechanical Equipment Room.

F. Second chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at top of plastic closure to allow for affixing approximately an 8" length of nickel plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be manufactured by Seton Name Plate Company, New Haven, Connecticut, or approved equal.

G. Identify all valves. A sample identification chart is provided below:

Valve Tagging Example

NUMBER	DESCRIPTION	LOCATION	NORMAL POSITION
1	Cold Water Supply to Water Heater	Mech. Room #121	Open
2	Cold Water Supply to Hose	Room #13	Open
3	Cold Water Supply to Equip in Room #12	Room #18	Open
4	Hot Water Supply to Toilet Room #212	Chase #210	Open
5	Air Vents-Cooling Coil #12 (2 required)	Fan Room #3122	Closed
6	Heating Hot Water Balancing Valve (Southwest Zone)	Above Ceiling Room #412	Marked On Valve

H. The above room numbers are examples only. (Actual room numbers shall be used).

2.22 MECHANICAL EQUIPMENT TAGGING

A. All mechanical equipment, including meters, fans, pumps, and other devices shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters/ Signs shall be securely attached by rustproof screws or some other permanent means (no adhesives).

B. Information on sign shall include name of equipment, rating, maintenance instructions, and other important data not included on factory attached nameplate.

C. Signs shall be attached to equipment so they can be easily read.

2.23 DUCT LABELING

A. Identify all ducts exposed in mechanical equipment rooms and pipe chases. Sample duct identification shall be as follows:

1. "Cold Duct - High Pressure - To Second Floor System"

2. "Exhaust Duct - Toilet Room - To EF-3"

3. "Ventilation Air Duct - To Utility Room #228"

B. Ducts shall be labeled at all wall penetrations and at connections to equipment.

C. All fire smoke dampers must be marked on the connecting ductwork or the wall being penetrated adjacent to the damper.

2.24 PIPE IDENTIFICATION AND LABELING

A. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. Pipes shall be identified at the following locations:

1. Adjacent to each valve.

2. At every point of entry and exit where piping passes through the wall or floor.

3. Every 50 feet on long continuous lines.

4. On each riser and junction.

5. Adjacent to all special fittings or devices (regulating valves, etc.)

6. Each connection to equipment.

B. Exempt Areas (where pipe labeling is to be omitted): Commons/Cafeteria with exposed structure, auditorium with exposed structure, gymnasiums with exposed structure, corridors with exposed structure. Pipe labeling shall be completed in all other areas with exposed structure including (but not limited to) shop areas, mechanical mezzanines, storage rooms, mechanical rooms, fan rooms, and utility rooms.

C. Apply markers so they can be read from floor.

D. Labels and markers shall be of the self-sticking, all temperature permanent type as manufactured by W.H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin, or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

E. Pipe color coding shall be uniform throughout.

F. Background colors shall be as follows:

Pipe Marking

Yellow:	Dangerous Materials (natural gas condensate, etc.)
Bright Blue:	Protective Materials (filtered water)
Green:	Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)

G. Letters of identification shall be 2" high for pipes 3" and larger in diameter, and 1" high for pipes 2-1/2" and less in diameter.

H. Markers shall be installed in strict accordance with the manufacturer's instructions.

I. On chalky and loose insulation, soft porous, fiber-filled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.

J. On bare pipes, painted pipes, and pipes insulated with a firm covering, pipe banding tape matching the background color of the marker shall be used for 360 deg. color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" of each end of marker, and should overlap approximately 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.

K. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance. If stenciling is used, letter heights, background colors, bending, and arrow shall be as specified above. Submit sample to Owner's representative before proceeding with work.

L. Underground utilities:

1. Provide and install a continuous plastic tape over the top of all underground utilities. Tape shall be placed half way between finished grade and top of utility line.

2. Plastic marking tape for underground utilities shall be acid and alkali-resistant Polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi cross wise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in above ground piping background color and shall bear a continuous printed inscription describing the specific utility.

2.25 CEILING MARKERS

A. Use stick on ceiling marker on all accessible ceiling grid to indicate location of VAV boxes, valves, and dampers.

2.26 PAINTING

A. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.

B. Mechanical Contractor: Spot painting for application of pipe and equipment identification markers. All piping exposed to weather.

C. Painting Contractor: All insulated piping and all piping in equipment rooms of finished areas shall be painted, as required by the painting specifications. Colors to be selected by owner.

PART 3 – EXECUTION

3.1 COORDINATION

A. All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.

B. Provide valves and unions or flanges at all pieces of equipment to allow maintenance.

C. Install all automatic valves, sensor well, flow switches, etc., as directed by the control contractor.

3.2 TESTING

A. All piping shall be tested in accordance with Section 23 0420 prior to applying insulation or concealing in partitions, wall, etc.

3.3 ACCESS

A. All valves and equipment shall be located to allow easy access for inspection, service and maintenance, test and balance, and operation. If valves are installed in inaccessible locations it shall be this contractor's responsibility to furnish and install access doors of a type approved by the owner's representative.

B. Locate piping, valves, etc. to allow easy access to and maintenance of equipment. Do not block walkways, filter access, maintenance access, or tube-pull space in equipment rooms.

3.4 LOCATIONS & ARRANGEMENTS:

A. All pressure gages shall be so installed as to be easily readable from an eye level 5'-6" above the floor.

B. Test plugs on flow measuring stations shall be unobstructed, and shall be arranged in the piping per manufacturer's recommendations.

C. All equipment and accessories shall be installed to facilitate proper service and maintenance in compliance with the manufacturer's recommendations.

3.5 WIRING BY THE ELECTRICAL CONTRACTOR

A. It is the intent of these specifications that all line voltage electrical power wiring and power connections to equipment be furnished and installed by the electrical contractor, unless otherwise specified or shown on the drawings.

B. The mechanical contractor shall coordinate actual job-site power requirements with the electrical contractor prior to installation of power wiring and electrical equipment. The electrical contractor shall provide necessary wiring to electric heat tape as required, and shall coordinate with the mechanical contractor the location and capacity of required circuits.

C. When mechanical system components are furnished with remote mounted control panels, alarm bells, alternators, etc. the electrical contractor shall run all required line voltage power wiring as directed by the mechanical contractor. It shall be the mechanical contractor's responsibility to coordinate the work and provide the necessary wiring diagrams.

D. When exhaust fans are provided which are not controlled by the ATC contractor, they shall be wired to local line voltage wall switches. The wall switch locations shall be coordinated with the owner's representative.

E. Line and low voltage control wiring will be furnished and installed by the ATC contractor in accordance with IEC and Division 26 with a minimum conduit size of 3/4".

3.6 STORAGE AND INSTALLATION OF MOTORS

A. Handle motors carefully to prevent damage, denting, and scoring. Do not install damaged motors or components; replace with new.

B. Store motors and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

C. Install motors where indicated on the drawings and in accordance with manufacturer's drawings and in accordance with manufacturer's published installation instructions.

D. Install each direct-connected motor such that it is securely mounted in accurate alignment. The drive must be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

3.7 INSTALLATION OF ABOVE GROUND PIPING

A. Provide piping systems of sizes indicated on the drawings. Systems shall be installed complete.

B. Install piping systems in conformance with ANSI B31.

C. Install piping to allow for expansion and contraction of the piping systems. Provide offsets and swing joint connections at coils, pumps and other equipment to eliminate undue strain to the equipment connections.

1. Connect flanges and tack weld piping systems in place before full circumferential welds are made.

2. Springing of piping at equipment connections will not be permitted.

3. The use of "cold-spring" is not permitted.

D. Branch connections to up feed systems shall be made at the top or at a 45 degree angle above the centerline.

E. Install 3/4 inch diameter plugged drain valve at each low point of water piping in mechanical rooms.

F. High Points: At each high point of the piping system provide a 3/8-inch diameter plugged globe valve.

1. Where high points are located in an inaccessible position, provide a 3/8-inch diameter bleed line from the high point of the piping system and extend to an approved location, with access. Anchor bleed piping and provide 3/8-inch diameter globe valve.

G. Support, anchor, and guide piping systems to preserve piping flexibility and the isolation effects of sound and vibration isolation hangers.

H. Conform to the welding and welder qualification requirements paragraph of this section.

1. Perform welding in conformance with ANSI B31.1

2. Perform welding in ambient temperatures above 0 degrees F.

3. Ream and clean ends of piping.

4. Support piping, align and tack weld making allowance for pipe pitch and insulation. Temporarily block piping at hangers.

5. Use welding pipe clamps on piping 4-inch diameter and larger, and verify alignment before welding.

I. All installed pipe lines shall be straight, free from dents, scars and burrs, with ends reamed smooth and shall remain straight against strains tending to cause distortion during system operation. The Contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage or improper operation will occur.

J. Piping shall be run in a neat and efficient manner and shall be neatly organized. Piping shall be run parallel or at right angles to the building walls or construction. The Contractor shall study the general, electrical, and other drawings to eliminate conflict of piping with structure, sheet metal, lighting, or other services. Unless specified otherwise, no piping shall be exposed in a finished room, all changes in direction shall be made with fittings.

K. All piping shall be clean and free from acids and loose dirt when installed.

L. Temporary pipe plugs of rags, wool, cottons, waste or similar materials shall not be used.

M. All piping shall be so arranged to not interfere with removal of other equipment or devices and shall not block access openings, etc.

N. Piping shall be arranged to facilitate equipment maintenance.

O. Flanges or unions shall be provided in the piping at connections to all items of equipment.

P. All piping shall be so installed to insure noiseless circulation.

Q. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated and adjusted at the completion of the work.

3.8 VALVE INSTALLATION

A. After piping system has been tested and put into service, but before final testing, adjusting and balance, inspect each valve for possible leak. Open and close each valve to verify proper operation.

3.9 INSTALLATION OF UNDERGROUND PIPING

A. Coordinate the routing and location of all underground piping with building footings. See structural drawings.

B. Outside pipe placed underground shall be buried deep enough to protect against freezing.

C. Depth of bury services shall be:

Buried Pipe Depth

SYSTEM	MINIMUM BURIED DEPTH
Sewer	48"
Rainwater	48"
Water	60"
Gas	36"
Fire	60"
Snowmelt*	24"

*Snowmelt tracer cable required along buried pipe length from building to manifold.

D. Services shall be buried at minimum depth unless site conditions or system requirements require pipes to be buried deeper.

E. Handling: Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bards and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. 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. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.

F. Coated and wrapped steel pipe shall be handled in conformance with AWWA Standard C203.

G. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contractor Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable

H. Copper tubing shall be cut square and all burrs shall be removed.

I. Locating: Where the location of the water pipe is not clearly defined by dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall, in all cases, cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

J. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

K. Copper tubing shall not be installed in the same trench with ferrious piping materials.

L. Nonferrous metallic pipe: Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.

M. Plastic pipe shall be insulated against heat from steam lines, water lines, or other heat sources.

N. Placing and Laying: Pipe and accessories shall be carefully lowered into the trench. Under no circumstances shall any of the materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Pipe shall be laid with the bells facing in the direction of the laying. The full length of each section of pipe shall rest solidly upon a compacted sand bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as required.

O. Where prescribed by the manufacturer of the pipe, gaskets shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gage in accordance with the pipe manufacturer's recommendations. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

P. Laying of gravity drain shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the pipe has a uniform invert. As the work progresses, the interior of the pipe shall be cleared of all superfluous materials.

Q. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints in gravity drain lines shall then be placed, fitted, joined, and adjusted so as to obtain the degree of water tightness required.

3.10 EXCAVATION

A. Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the owner.

B. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Sheeting and shoring for the work and for the safety of personnel shall be in compliance with applicable safety standards.

C. Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the manufacturer's installation manual. The trench width below the top of the pipe shall not exceed that recommended in the installation manual. Where no manufacturer's installation manuals are available, trench walls, below the top of the pipe shall be vertical, and trench walls above the top of the pipe shall be sloped as required to properly complete the work. Trench width below the top of the pipe shall not exceed 24 inches plus pipe outside diameter (O.D.). Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased cost of the pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

D. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing loads.

E. Removal of Unyielding Material: Where over depth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials.

F. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

G. Excavation for Appurtenances: Excavation for manholes, catch basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structural footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.11 BACKFILLING

A. Backfill material shall consist of satisfactory material. Backfill shall be placed in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density unless otherwise specified.

    1. Degree of compaction expressed as a percentage of maximum density is obtained by the test procedure presented in ASTM D 1557.

B. Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of the pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure tests.

C. Replacement of Material: Material removed from the bottom of the trench shall be replaced with 6" sand base prior to the installation of the piping. Piping shall be encase in sand with a 6" top layer over the top of the piping.

D. Initial backfill material shall be placed in layers of a maximum of 4 inches loose thickness and compacted with approved tampers to the density of the adjacent soil and to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of pipe for full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Backfill material in the portion of the trench shall consist of satisfactory material at a moisture content that will facilitate compaction free from stones of such size as recommended by the pipe manufacturer, or larger than 2 inches in any dimension, whichever is smaller, except that where the pipe is coated or wrapped for protection against corrosion, the backfill material shall be free of stones larger than 1 inch in any dimension, or as recommended by the pipe manufacturer, whichever is smaller.

E. The remainder of the trench, except for special materials for roadways, shall be backfilled with satisfactory material.

3.12 INSTALLATION OF GAS VALVES

A. Gas Cocks: Provide and install gas cocks at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated on the drawings. Locate gas cocks where easily accessible and where they will be protected from possible injury.

B. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility company's requirements and manufacturer's installation instructions. Install gas shutoff valve upstream of each pressure regulating valve. Each pressure regulating valve shall have an independent vent piped to the outside of the building. Vents shall be terminated with an approved bug screen fitting.

3.13 INSTALLATION OF NATURAL GAS PIPING SYSTEMS

A. General: Install natural gas piping as shown on the drawings in accordance with NFPA 54 and as follows.

B. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.

C. Unless otherwise indicated, gas piping shall be run exposed. Where concealed piping is indicated, it shall be installed inside of a welded steel casing which is vented on both ends and in a location to permit access to the piping casing with a minimum amount of damage to the building.

D. The gas supply pipe shall be of the size indicated on the drawings.

E. A stop cock or tee handled gate valve, with cast-iron extension box and cover, shall be installed in the gas supply pipe near the curb. A brass gas cock shall be installed in the gas supply pipe just inside the building wall. If the gas supply pipe is larger than 2-inch size, a bronze mounted iron body gate valve may be provided in lieu of the brass cock.

F. Joints shall be welded from the seismic shut-off valves to the gas train connections at the boilers. Other non-welded joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed and all burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.

G. An approved type gas cock shall be installed in the branch connection to each riser and near each appliance. Plugged or capped outlets for future extensions or connections shall be provided where noted on drawings.

H. Piping shall be graded not less than 1-inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.

I. A full-size tee fitting and a 6--inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.

J. Uncovered, exposed pipes shall be provided with plates at the point where they pass through floors, furnished walls, and finished ceilings. Where necessary to cover beads of fittings, special deep escutcheons shall be provided in lieu of plates. Plates shall be not less than 0.018-inch thick. Wall and ceiling plates shall be secured with round head set screws, not with spring clips. Unless otherwise specified, plates shall be of the one-piece types. Wall and ceiling plates may be flat, hinged pattern.

K. Unions shall be installed in the gas piping between the gas burning appliance and the gas shut-off valve serving the appliance.

L. Gas piping exposed outside shall be painted with two coats of ultra-violet (UV) resistant coating.

3.14 INSTALLATION OF THERMOMETERS AND THERMOMETER WELLS

A. General: Install thermometers and thermometer wells at locations shown on the drawings and where specified. Install thermometers so that they can be read by a person standing on the floor and with normal illumination.

B. Locations: Install thermometers and thermometer wells at the following locations, and elsewhere as indicated.

1. At the inlet and the outlet of each hydronic zone.

2. At the inlet and the outlet of each hydronic boiler and chiller.

3. At the inlet and the outlet of each hydronic coil in air handling units.

4. At the inlet and the outlet of each hydronic heat exchanger.

5. Thermometer Wells: Drill and tap pipes 5-inch and larger for installation of wells. Provide tees or reinforced welding fittings on pipes smaller than 5-inch for installation of wells. Provide oversize tees or enlarge pipe smaller than 3-inch at points where wells are installed to avoid restriction of flow.

3.15 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges at locations shown on the drawing and where specified.

B. Locations: Install pressure gauges in the following locations, and elsewhere as indicated.

1. At the suction and the discharge of each pump.

2. At the discharge of each pressure reducing valve.

3. At the water service outlet.

4. At the inlet and the outlet of the air cooled chillers.

C. Pressure Gauge Cocks: Provide stem mounted pressure gauges with T-handle cocks and pressure snubbers.

3.16 INSTALLATION OF FLOW METERS

A. General: Install flow meters at locations shown on the drawings and where specified. Install in accordance with ASME recommendations for flow meters.

B. Locations: Install flow meters in the following locations, and elsewhere as indicated.

1. At the discharge of each pump (except where indicated otherwise).

2. At the inlet of each hydronic coil in built-up central systems.

C. Piping: Install piping in the exact locations and arrangement, both upstream and downstream of primary elements, as required by the manufacturer's published literature. Provide any necessary piping changes required for certification without additional cost.

D. Horizontal Pipe: Provide the connection nipple at, or slightly above, the horizontal centerline of the pipe to minimize the entrance of gases and impurities when flow is measured in horizontal pipe.

E. Taps: Provide taps with shut-off valves and quick connecting hose fittings for portable meters or double-ferrule compression fittings for connection to tubing for permanently located meters or recorders.

F. Portable Flow Meter Connections: Install connections for attachment to portable flow meter hoses that are readily accessible.

SECTION 23 1800
INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. It is the intent of this section of the specifications that all hot (above 105 deg. F) and cold (below 55 deg. F) surfaces of all piping and mechanical system components be insulated, unless specifically excluded herein.

B. Systems to be insulated:

1. Chilled water piping systems
2. Chilled water air separator
3. Chilled water pumps
4. Domestic cold water piping systems
5. Domestic hot (120 deg F) and hot recirculating piping systems
6. Domestic hot (140 deg F) and hot recirculating piping systems
7. Domestic hot water storage tanks
8. Heating hot water air separator
9. Heating hot water piping systems
10. Refrigerant suction and liquid lines
11. Roof drain piping systems
12. Snowmelt piping systems
13. Kitchen cooler and freezer box drains and lines
14. Water & waste piping exposed below plumbing fixtures
15. Supply air ductwork
16. Make-up air unit ductwork
17. Outside air ductwork from louver/roof hood/penthouse to air handler.
18. Grease hood ducts

C. The providing of all materials, supplies, equipment, tools, transportation, and facilities and performing all labor and service necessary to provide the work outlined above and as shown on working drawings.

PART 2 – PRODUCTS

2.1 COMPLIANCE

A. All insulation shall (as a minimum) conform to the requirements of the IMC 2018 602.2.1.8 and having a flame spread index of less than 25 and smoke developed index less than 50.

B. Insulation shall be manufactured by Armstrong, Certaineed, Johns-Manville, Knauf, or Owens-Corning.

2.2 PIPING

A. All piping shall be insulated with 2-piece heavy density pipe insulation having an average thermal Conductivity in the range given in the Minimum Pipe Insulation Thickness table below. Thickness of insulation shall be as follows:

Minimum Pipe Insulation in inches

PIPING SYSTEM TYPES	FLUID TEMP. RANGE, (deg. F)	CONDUCTIVITY (Btu-in./(h-ft^2-deg F))	<1"	1" TO <1 1/2"	1 1/2" TO <4"	4" TO <8"	8" TO >8"
HEATING HOT WATER	141-200	0.25-0.29	1.5	1.5	2.0	2.0	2.0
CHILLED WATER	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
DOMESTIC HOT WATER (120 deg F)	105-140	0.21-0.28	1.0	1.0	1.5	1.5	1.5
DOMESTIC HOT WATER (140 deg F)	141-200	0.25-0.29	1.5	1.5	2.0	2.0	2.0
DOMESTIC COLD WATER	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
REFRIGERANT SUCTION LINE	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
COLD BOX DRAIN LINE	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
REFRIGERANT LIQUID LINE	105-140	0.21-0.28	1.0	1.0	1.5	1.5	1.5
ROOF DRAIN	<40	0.20-0.26	0.5	1.0	1.0	1.0	1.5
SNOW MELT	141-200	0.25-0.29	1.5	1.5	2.0	2.0	2.0

a. Piping in conditioned partitions may have insulation reduced by 1" to a minimum insulation of 1" if piping diameter is less than 1 1/2". See IECC 2018 403.11. Reduced insulation length must be less than 12 ft.

b. For piping exposed to outdoor air, increase thickness by 1/2"

c. Direct buried Hot water may have insulation reduced by 1 1/2" to a minimum insulation of 1", see IECC 2018 403.11.

B. All insulated piping inside rooftop units, in Boiler Room, and in other mechanical and fan rooms shall be covered with a heavy duty PVC cover. Cover shall be colored per type of pipe content with I.D. and flow on cover.

1. Jacket colors:

a. Chilled Water Supply – Dark Blue
b. Chilled Water Return – Light Blue
c. Heating Hot Water Supply – Red
d. Heating Hot Water Return – Light Red
e. Domestic Cold Water - Green
f. Domestic Hot Water – Orange
g. Domestic Hot Water Re-circ – Light Orange
h. Domestic Soft Water – Light Green
i. Roof Drain – Light Purple

2. Insulation installation shall be inspected by the owner's representative prior to installing cover.

C. Exposed CHWS and CHWR piping at chiller enclosure shall be covered with an aluminum all weather jacket.

D. Pipe insulation shall be covered with an all-service jacket.

E. Insulated piping run exposed in occupied areas shall have a white PVC cover.

F. Pipe insulation & vapor barrier shall be run continuous thru all walls and floors.

2.3 ROOF DRAIN PIPING

A. Roof drain bowls shall be insulated with a minimum insulation of 1".

B. Roof drain piping and fittings running exposed in occupied public areas shall be covered with a white PVC cover.

2.4 WATER & WASTE PIPING EXPOSED BELOW PLUMBING FIXTURES

A. Insulate all exposed surfaces of the waste piping and supplies with an approved ADA insulation kit as required by sink manufacturer.

2.5 LOW PRESSURE ROUND DUCTS

A. All round metal ducts shall be wrapped with 1" thick fiberglass duct wrap with factory-applied vapor barrier. All joints shall be sealed with mastic and taped to form a neat and complete insulation system.

2.6 CHILLED WATER EQUIPMENT

A. Insulate chilled mechanical equipment with the exception of expansion tanks, with removable and replaceable covers consisting of No. 20 gauge galvanized sheet metal jacket lined with 2" thick high density polystyrene insulation. The insulation shall have an average "k" factor of 0.22. All voids between insulation and housing shall be filled insulation. Closure joints of metal casing shall be vapor-sealed after the covers are in place.

2.7 DOMESTIC PIPING BELOW SLAB

A. Piping shall be insulated with 1/2" thick armaflex close cell flexible foam insulation.

2.8 REFRIGERANT SUCTION PIPING.

A. Exposed refrigerant suction and liquid lines on roof shall be covered with an aluminum all weather jacket.

2.9 MEDIUM PRESSURE DUCTS

A. Medium pressure ducts shall be externally insulated with 1 1/2" thick 1.0 lb. density mineral fiberglass insulation. Insulation shall be furnished with an integral FSK vapor barrier jacket. Insulation shall be applied with edges tightly butted and secured by impaling on pins welded to the duct or on metal clips, previously adhered to the ducts with manufacturer's adhesive. Pins or clips shall be spaced to hold insulated firmly against the duct surface. Where required, insulation on the underside of all horizontal ducts and sloping ducts shall be additionally secured by applying an adhesive. All penetrations shall be sealed with vapor barrier adhesive. All seams shall be covered with 2" wide strips of same insulation facing material adhered with adhesive.

2.10 FLEXIBLE DUCT

A. Flexible supply air ducts shall be insulated with 1" thick 1.5# density duct wrap with vapor barrier. All flexible supply ducts must conform to flame index requirements of this section and be UL 181 certified as Class 1 duct insulation. The certification must be marked on the outside of the insulation.

2.11 LOCKER AND SHOWER ROOM DUCTWORK

A. All concealed metal ducts shall be wrapped with 1" thick fiberglass duct wrap with factory-applied vapor barrier. All joints shall be sealed with mastic and taped to form a neat and complete insulation system.

B. Exposed duct shall not be lined or wrapped.

2.12 MAKEUP AIR UNIT SUPPLY DUCT

A. Wrap makeup air unit supply duct with 1" thick fiberglass blanket with FSK barrier. Do not line make-up air ductwork.

2.13 DUCTS ABOVE ROOF

A. Ducts above roof shall be covered with 2" thick 3 lb. density rigid duct board secured with duct clips and covered with .016" aluminum sheet as hereinafter specified.

B. Material shall be Class 1 factory certified with UL 181.

2.14 GREASE HOOD DUCTS

A. Ducts to be wrapped with a refractory ceramic fiber blanket with reinforced aluminum foil cover. Blanket to be installed in accordance with manufacturer's recommendations. Product to be "Firemaster" blanket duct wrap as manufactured by Thermal Ceramics or approved equal.

2.15 OUTSIDE AIR DUCTWORK

A. All surfaces of the outside air ductwork shall be insulated with 3" thick - 3lb. density blanket duct. Insulation shall be furnished with an integral FSK vapor barrier jacket. Insulation shall be applied with edges tightly butted and secured by impaling on pins welded to the duct or on metal clips, previously adhered to the ducts with manufacturer's adhesive. Pins or clips shall be spaced to hold insulated firmly against the duct surface. Where required, insulation on the underside of all horizontal ducts and sloping ducts shall be additionally secured by applying an adhesive. All penetrations shall be sealed with vapor barrier adhesive. All seams shall be covered with 2" wide strips of same insulation facing material adhered with adhesive

PART 3 – EXECUTION

3.1 GENERAL

A. The contractor shall provide a complete installation which is neat in appearance and functional.

B. Remove all excess materials and packaging from job site.

C. All insulation shall be continuous thru wall and ceiling openings and thru sleeves.

D. Terminations of insulation on piping shall be tapered and coated with finish cement.

E. Insulation on all cold surfaces where vapor barrier jackets are used will be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.

F. Valves and fittings inside the building shall be insulated as specified for the piping systems and covered with high temperature P.V.C. insulation fitting covers.

G. Fittings and valves for pipe size smaller than 4" shall be insulated and finished with Insulating and Finishing Cement to a thickness equal to the adjoining pipe insulation. Fittings and valves for pipe sizes 4" and larger shall be insulated with segments of the molded insulation secured with No. 20 gage galvanized annealed steel wire finished with a smoothing coat of finishing cement. Vapor seal with a layer of glass fabric embedded between two 1/16" coats of vapor seal adhesive. Lap seal outer jacket at least 1" on itself adjoining insulation.

H. In exposed areas, all fittings shall be additionally finished with FSK wrap smoothly adhered. Overlap the FSK wrap on itself and adjoining pipe insulation. Overlap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above. Piping exposed in occupied areas shall have a white PVC cover installed.

I. Insulation inserts and shields for all insulated piping 1-1/2” a larger shall be installed at all pipe hangers. Inserts between the pipe and pipe hangers shall consist of calcium silicate block insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier on cold surface piping. Insulation inserts shall not be less than the following lengths, unless otherwise approved on submittals:

Insert Lengths

Pipe Size	Insert Length
1/2" to 2-1/2"	6"
3" to 6"	9"
8" to 10"	12"

J. Rigid metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and length specified for the insulation hanger inserts.

K. Vapor barrier wrap shall be sealed tight and not penetrated by the hanger or shield.

L. Block insulation shall be applied with edges tightly butted, joints broken, secured with No. 16 gauge galvanized annealed steel wire or 1/2" x .015" galvanized steel bands on 12" maximum centers for large areas. Where required, welded studs, clips, or angles shall be provided as anchored for fire and bands. Finish shall be Insulating and Finish Cement applied 1/4" thick in one coat, troweled to a smooth finish. Over the Insulating and Finishing Cement a FSK jacket cloth shall be smoothly adhered with vapor barrier adhesive.

M. Insulation blocks shall be applied with edges tightly butted, joints broke, and secured with No. 14 gauge galvanized annealed steel wire, or 1/2" X 0.15" galvanized steel bands on 12" maximum centers for large areas. Where required, welded studs, clips, or angles shall be provided as anchored for wires and bands.

N. Over the insulation, 1" hexagonal mesh wire shall be tightly stretched in place and secured by wiring to anchors, with edges tied together. Finish shall be Johns-Manville No. 3011 Insulating and Finishing Cement or approved equal applied 1/4" thick in one coat, troweled to a smooth finish.

O. Over the Insulating and Finishing Cement, pre-sized glass cloth shall be smoothly adhered with Adhesive.

P. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.

Q. Where insulation pipes pass thru sound or fire-rated walls, floors, or ceilings, the insulation sleeves shall be sound or fire-rated to match rating of surface penetrated.

R. All insulation which runs outside of the building, or inside of the building in areas where the insulation will be exposed to physical abuse, shall be jacketed with a minimum thickness of .016 inch aluminum. The insulation and aluminum shall be secured in place by a continuous friction type joint to provide a positive weatherproof seal along the entire length of the aluminum jacket. Then, an aluminum preformed strap containing a permanently plastic weatherproof sealant shall be centered over each circumferential joint, and secured by tightening on a clip, or by use of separate 1/2 inch wide stainless steel banding. All elbows, tube, turns, sweeps, and bends shall be insulated with mitered sections of aluminum-jacketed insulation. Joints shall be sealed with a sealing compound and preformed aluminum bands, Valves shall be covered by prefabricated sections of aluminum-jacketed insulation according to manufacturer's recommendation.

S. All insulation which runs inside of the building in areas where the insulation will be exposed to physical abuse, shall be jacketed with a heavy duty PVC jacket. The insulation and PVC shall be secured in place by a continuous friction type joint to provide a positive weatherproof seal along the entire length of the jacket. Then, an aluminum preformed strap containing a permanently plastic weatherproof sealant shall be centered over each circumferential joint, and secured by tightening on a clip, or by use of separate 1/2 inch wide stainless steel banding. All elbows, tube, turns, sweeps, and bends shall be insulated with mitered sections of PVC-jacketed insulation. Joints shall be sealed with a sealing compound and preformed aluminum bands, Valves shall be covered by prefabricated sections of PVC-jacketed insulation according to manufacturer's recommendation.

T. Insulation at storage tanks, manholes, hand holes, and at flanged ends of heat exchangers shall be applied so that these items can be removed without damaging the insulation.

U. Pipe insulation subject to damage from regular traffic shall be covered with a full PVC jacket.

3.2 INSULATION WORKMANSHIP

A. All insulation shall be applied by specialists experienced in the field, and shall be neat in appearance. Neatness in appearance shall be equated to proper insulation application procedures, and sloppy workmanship will not be tolerated. Work which is deemed unacceptable shall be condemned, removed, and replaced at the contractor's expense.

B. Protect floors, valve handle, accessories, etc., to keep paste off areas not being insulated.

C. Splitting of longitudinal sections on flexible foam pipe insulation will not be permitted.

D. Do not install insulation on pipes which require heat taping without coordinating with mechanical contractor.

3.3 CLEAN-UP

A. The piping shall be cleaned and tested prior to installation of insulation.

B. Fittings shall be cleaned after insulation is installed.

SECTION 23 4000
PLUMBING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Piping diagrams are schematic and indicate preferred pipe routing. It is the intent that the installation be complete. Where fixtures are not shown connected to any required services, they shall be connected properly and completely. Connect all fixtures to various services, i.e., hot water, cold water, waste, and vent, etc., as required.

B. The work shall include furnishing of all materials and labor required for the job as described, together with all accessories and trim implied or required to finish the work, and generally as follows:

1. Complete rain removal system, including piping and roof drains.
2. Plumbing fixtures and piping.
3. Sanitary sewer systems.
4. Indirect drain systems for new kitchen equipment.
5. Make-up & condensate drains for HVAC systems.
6. Water softener.
7. Condensate drain systems.
8. Kitchen equipment connections.
9. Grease interceptor and sampling manhole.
10. Compressed air systems
11. Backflow prevention systems.
12. Final connection of building systems to site utilities.

1.2 STANDARDS

A. Plumbing installation shall be made in accordance with the International Plumbing Code, City Code, and all other governing codes.

B. In the event drawings violate the codes as being locally enforced, the contractor shall base his estimate on the enforced code requirements.

1.3 DISINFECTING

A. After flushing the mains, introduce a water and chlorine solution concentrated to 300 PPM to disinfect the system and oxidize piping contaminates. Retain treated water and chlorine for a period of not less than three hours or more than six hours before final flushing out of system.

B. All valves should be opened periodically during the process and the residual chlorine checked to ensure that at least 50 percent of the initial concentration is present to complete the disinfection. If there is less than 50 percent, the valves should be allowed to drain water until the 50 percent or greater level is obtained. A make up chlorine solution of a concentration equal to the initial concentration must be added as needed during the withdrawal of the spent solution.

C. A warning sign shall be conspicuously posted at each water outlet and faucet during the disinfecting process to prevent occupants from drinking the water.

D. Flushing: Following disinfection, all treated water shall be flushed from the system through its extremities. Flushing shall continue until samples show that the quality of the water delivered is comparable with the quality of the public water supply and satisfactory to the public health authority having jurisdiction. Flushing shall be repeated if samples taken daily over a period of three days show the water quality is not being maintained. Samples shall be taken only from taps located and installed in such a manner that they will not contribute any contamination. Samples shall not be drawn from hydrants or through unsterilized hose. Test samples shall be certified by a recognized and approved testing laboratory, and a certificate of acceptability shall be submitted.

E. Written certification of the disinfecting process and purity of water samples shall be forwarded to the Owner's representative.

1.4 VERIFICATION OF GRADE

A. The contractor shall verify with the site utilities contractor the connection of water, storm drain, and waste piping systems to the mains, and shall verify the actual job site elevation and location prior to the installation of the building footings.

PART 2 – PRODUCTS

2.1 CLEANOUTS

A. Approved cleanouts shall be installed in the base of each vertical drainage line, and in the horizontal line at each change in direction. In addition, there shall be cleanouts spaced at a maximum of 50' in all horizontal lines. All cleanouts shall be extended to accessible surfaces. All cleanouts to grade shall be capable of cleaning in both directions.

B. Do not install floor cleanouts in corridors or hallways. Provide accessible wall cleanouts in corridors and hallways.

C. Cleanout covers in finished walls shall be chrome finish. Floor covers shall be polished bronze.

2.2 WATER HAMMER

A. Provide and install brass or stainless steel bellows type shock absorbers in the ends of all multiple fixture water lines and in piping ahead of snap-acting automatic valves.

B. Absorbers shall be sized and located in compliance with manufacturer's recommendations for the specific application. Absorbers shall be Zurn, Wade, or Smith.

C. Absorbers shall not be installed in inaccessible areas. Extend piping to accessible locations.

2.3 FLASHINGS

A. All pipes passing thru the roof shall be neatly flashed with watertight 4# sheet lead flashing, with lead rain collar, and clamping collar, or as required by roofing manufacturer, fitting snugly around the pipe, extended to the top and, when required, finished with a code approved vent cap. The flange around the base shall be at least 18" square. Flashings shall be provided by this contractor.

2.4 FIXTURE STOPS

A. All stops for plumbing fixtures shall be loose key McDonald 1/4 turn ball valves or prior approved equal.

2.5 PLUMBING FIXTURES

A. This contractor shall furnish and install all fixtures shown on the architectural or mechanical drawings or specified hereinafter, clean and adjust all fixtures and replace any damaged fixtures at the contractor's expense.

B. The fixtures shall be all new and complete as shown and described in manufacturer's catalog, and as required for the work, including accessible loose key 1/4 turn ball valve stops above the floor in supplies to all fixtures, and cast brass P-traps, unless otherwise shown. Trim for all fixtures shall be chrome-plated, and all trim shall match in design. Supply faucets shall have renewable seats and barrels.

C. **Approved Fixtures**

Water closets, urinal & lavatories:	Kohler, American Standard, Crane, or approved equal.
Flush valves:	Zurn, Sloan, or approved equal.
Sinks:	Just, Elkay, or approved equal.
Faucets:	Moen, T&S Brass, American Standard, or approved equal.
Drinking fountains:	Murdock, Acorn, Elkay, or approved equal.
Shower trim:	Symmons, Bradley, T&S Brass, Moen, or approved equal.
Hose bibbs:	Watts, Zurn, JR Smith, Woodford, or approved equal.
Emergency fixtures:	Bradley, Symmons, Haws, or approved equal.
Tempering valves:	Bradley, Symmons, Watts, or approved equal.
Floor drains, floor sinks:	Zurn, JR Smith, Watts, Josam, or approved equal.
Trench drains:	JR Smith, Josam, Zurn, or approved equal.
Roof drains, downspouts:	Zurn, Watts, JR Smith, or approved equal.

PLUMBING FIXTURES

WC-1	Water Closet:	Kohler K-4330 'Kingston' siphon jet, wall hung, elongated bowl, 1-1/2" top spud; Sloan 'Gem-2 111 SFSM-1.6-XL' battery powered 1.6 gpf chrome plated flush valve (EBV500A-G actuator); K-666C 'Bemis 1955C extra heavy solid plastic white open front seat with stainless steel check hinge; Wade W-311 (horizontal) or W-331 (vertical) series carrier, single or double right or left as required, with foot support.
WC-2	Water Closet: (ADA)	Same as "WC-1" - Set at handicapped height.
WC-3	Water Closet: (ADA)	American standard "Madera" 3461 - siphon jet, floor-mounted, extended lip bowl, 1-1/2" top spud, vitreous china, Zurn ZR6000AV 1.6 gpf chrome plated, battery powered sensor flush valve;; K-4666-C "Lustra" extra heavy solid plastic white open front seat with stainless steel check hinge; 431310-100 bolt caps.
WC-4	Water Closet:	American standard "Madera" 3451 - siphon jet, floor-mounted, extended lip bowl, 1-1/2" top spud, vitreous china, Zurn ZR6000AV 1.6 gpf chrome plated, battery powered sensor flush valve;; K-4666-C "Lustra" extra heavy solid plastic white open front seat with stainless steel check hinge; 431310-100 bolt caps.
U-1	Urinal:	Kohler #K-4960ET "Barton" vitreous china, wall hung, siphon jet with flushing rim, 2" outlet connection, 3/4" top spud with Sloan GEM-2 186 SFSM -1.0-XL battery powered sensor operated chrome plated flush valve with vacuum breaker and battery, plate type carrier and bearing plate. Wade W-452, Zurn 1222, Smith 633.
U-2	Urinal: (ADA)	Same as U-1 set at handicapped height.
L-1	Lavatory: (ADA)	Kohler K2905-4 "Greenwich" 20" x 18" - 4" center set vitreous china, front overflow, anti-splash rim, center basin, wall hanger, punched for concealed arm carrier, Kohler K-13460, battery powered sensor faucet, grid strainer, tailpiece and flexible supplies w/stops and brass P-trap. Support lavatory with Zurn ZN1231 concealed arm carrier with foot support. Provide ADA insulation kit for hot, cold, tempered, and drain/P-trap.
S-1	Sink – Shops	Just J-4820-S seamless welded construction of 14 ga. Type 304 stainless steel. 1-1/2" roll rim on front and sides. Interior surfaces polished with hand blended finish. Exposed exterior finish surfaces to have brush standard finish. 14 ga., type 304 stainless steel wall brackets and 14 ga. Stainless steel wall clips. Drain punch for (just – J-35-FS Drain) or matching manufacture drain. (2) (JSL-46-B) or equal sensor operated, backsplashed mounted faucet with gooseneck spout and laminar flow control. Chrome plated cast brass p-trap , and thermostatic mixing valve

S-2	Sink –Band Room	Elkay Custom 28" x 22" Top 22″ x 16″ C 10-1/2" D, 18 gauge 304 stainless steel, drilled for 3-hole rear ledge center set faucet and right ledge bubbler, self-rimming, sound dampening, cup strainer, and "U" channel mounting system Chicago 1100-GN2AE3-317AB gooseneck faucet with ADA levers, aerator, flexible supplies, brass P-trap, Watts USG-B ASSE 1070 thermostatic mixing valve and right side Chicago 748-665CP bubbler with separate ¼ turn ball valve for bubbler.
S-3	Sink –Choir	Just SLX-2225-A-GR 25" x 22" top, 21" x 16" x 10 1/2" deep bowl, 18 ga. stainless steel, self-rimming, sound dampening, cup strainer, Chicago Faucets 201-AGN8AE35XKABCP faucet with rigid gooseneck spout, 4" wrist blade handles, and vandalproof aerator, flexible supplies,
S-4	Sink – Dressing room	Just SL-1815-A-GR 18" x 15" top, 12" x 12" x 7 1/2" D, 18 ga., 304 stainless steel, drilled for 3-hole centerset faucet, self-rimming, sound dampening, cup strainer, American Standard 'monterrey' 6540, 4" wrist blade handles, and aerator, flexible supplies, brass P-trap.
S-5	Sink – Sick room	Just SL-1815-A-GR 18" x 15" top, 12" x 12" x 7 1/2" D, 18 ga., 304 stainless steel, drilled for 3-hole centerset faucet, self-rimming, sound dampening, cup strainer, American Standard 'monterrey' 6540, 4" wrist blade handles, and aerator, flexible supplies, brass P-trap.
S-6	Sink – Faculty room	Just DL-1933-A-GR, 19" x 33" X 7 1/2", 18 ga. 2-compartment stainless steel, drilled for 3-hole 8" centerset faucet, self-rimming, sound dampening, and cup strainers. Chicago 201-AGN8AE35XKABCP gooseneck rigid/swing faucet, 2-3/8" lever handles, vandal resistant full flow aerator, and ceramic cartridges. Provide flexible supplies, and chrome plated brass tailpiece & P-traps.
S-7	Sink - Labs	Just SLX-2225-A-GR 25" x 22" top, 21" x 16" x 10 1/2" deep bowl, 18 ga. stainless steel, self-rimming, sound dampening, cup strainer, Chicago Faucets 201-AGN8AE35XKABCP faucet with rigid gooseneck spout, 4" wrist blade handles, and vandalproof aerator, flexible supplies,
D-1	Disposer	In-Sink-Erator stainless steel Evolution Compact Garbage Disposal, 3/4 HP @ 120/1/60. Built-in overload with manual reset and automatic reversing switch.
SS-1	Service Sink: (Floor type)	Kohler K-6710 "Whitby" 28" x 28" service sink, floor mounted, drain channels; Moen 8124 polished chrome faucet with vacuum breaker, hose end with hose, bucket hook, wall brace integral stops and rough chrome finish. Faucet to be mounted 30" above finish floor; K-8940 rim guard; K-9146 drain with strainer for 3" connection.

DF-1	Drinking Fountain:	Elkay LZSTLG8WSSK bi-level, wheelchair access, double bowl, wall mounted, air cooled, refrigerated type with bottle filler to cool 8 gal/hr. from 80 deg. F. to 50 deg. F. with 90 deg. F. EAT. 1/5 HP hermetic compressor, 120/1/60. 304 stainless steel top w/chrome plated bubbler and push bar operable from front and sides of fountain. Cabinet color shall be stainless steel #4, satin finish. Note: Cut electrical cord at time of installation to suit electrical outlet provided.
SH-1	Shower Trim:	Bradley Model 1C-SVL-SF-AKV-LBJ-15 single lever compression shower valve with volume control and adjustable temperature limit. Shower shall have shower head w/ ball joint and shower arm with wall flange.
SH-2	Shower Trim: (ADA)	Bradley Model 1C-EF-SF-AKV-LBJ-15 single lever compression shower valve with volume control and adjustable temperature limit. Shower shall have shower head w/ ball joint and shower arm with wall flange. Hand held 60" SS hose w/spray head, Bradley Model DV diverting valve and vacuum breaker. All items shall be set to handicapped heights & comply with standards of the Utah State Physical Handicapped Code.
IMB-1	Ice Maker Box:	Guy Gray BIM-875 for in-the-wall installation with concealed piping, 1/2" ball valve. 18 gauge dipped galv. steel finish. Face plate with 20 gauge box. (Verify mounting height with conditions).
WB-1	Washer Box:	Guy Gray SSWB3 for in-the-wall installation with concealed piping, dual 1/2" ¼ turn arrester valves with hose connections and 2” drain connection. Stainless steel box construction and finish. (Verify mounting height with existing conditions). Provide 2" stand pipe drain with P-trap for waste connection.
HB-1	Hose Bibb:	Zurn Z-1310 3/4" "Ecolotrol" non-freeze anti-syphon wall hydrant with bronze casing and plain bronze face, provide with loose key and set screw for each hydrant.
HB-2	Hose Bibb:	Zurn Z-1350-EZ Narrow wall cold hydrant, for interior wall installation. Bronze body, all brass interior parts, replaceable seats and washers, handle operated control valves, and mounting brackets. Stainless steel box and hinged cover with operating key lock and "WATER" stamped on cover.
HB-3	Hose Bibb:	Woodford model 24, 3/4" sill faucet with 3/4" hose thread outlet with removable tee handle, chrome-plated with wall flange and vacuum breaker.

ESW-1	Emergency Shower/ Eyewash Combination:	Guardian - G1902SSH - Combination eyewash/shower safety station with stainless steel shower head internal 20 GPM flow control, stainless steel eyewash bowl, powder-coated cast aluminum flag handle and floor flange, 1 ¼" IPS Schedule 40 galvanized pipe and fittings, powder coated finish (Green), 1" IPS and ½" IPS U.S. made chrome-plated brass stay-open ball valves, and polished stainless steel pull rod. Unit shall have (2) polypropylene spray heads with integral "flip-top" dust covers, filters, and 1.6 GPM flow control orifices mounted on a chrome-plated brass eyewash assembly. Unit shall include ANSI compliant sign. Unit shall meet or exceed ANSI Z358.1 – 2014, and come with a full 2-year warranty.
EW-1	Emergency Eyewash:	Guardian G1814– Wall mounted eyewash with stainless steel bowl, ½" U.S. made chrome plated brass stay open ball valve, powder coated cast aluminum flag handle and wall bracket chrome plated brass tailpiece and trap with 1-1/2" waste connection. Unit shall have (2) polypropylene spray heads with integral "flip-top" dust covers, filters and 1.6 GPM flow control orifices mounted on a chrome plated brass eyewash assembly. Unit shall include ANSI compliant sign. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 – 2014, and come with a full 2-year warranty.
AO-1	Air Outlet:	1/2" quick disconnect coupling with both male and female portions. Lincoln or equal.
TV-1	Tempering Valve:	Watts series USG-8 (ASSE 1070) tempering valve, 3/8" inlets and 3/8" outlet, to mix cold water with 120 deg. F. hot water for 110 deg. F. tempered water supply. .50 GPM min. flow and 1 GPM at 10 psi pressure drop. Tempering valve shall be complete with check stops, bronze body, and adjustment cap with locking feature. Valve shall be installed as high as possible below sink or lav.
TV-2	Tempering Valve: (Emergency Shower/Eyewash)	Leonard Model TM-800-0 emergency tempering valve, 1" inlets and 1-1/4" outlet, to mix cold water with 120N F. hot water for 85N F. tempered water supply. 1.0 GPM min. flow and 44 GPM at 20 psi pressure drop. Manifold shall be complete with temperature gauge, inlet check stops, and cold water bypass.
TV-3	Tempering Valve: (Emergency Eyewash)	Leonard Model TA-300-RF emergency mixing valve, 1/2" inlets and 1/2" outlet, to mix cold water with 120 deg. F. hot water for 85 deg. F. tempered water supply. 0.5 GPM min. flow and 6 GPM at 20 psi pressure drop. Manifold shall be complete with temperature gauge, inlet check stops, and cold water bypass.
FD-1	Floor Drain:	Zurn #Z-415-4 2" cast iron drain with nickel bronze round top. Drain to have deep seal P-trap. Provide Pro Vent systems Proset trap guard in all FD-1 floor drains where no trap primer is connected. P-trap to have trap primer connection where trap primer piping is shown on drawings.

FD-2	Floor Drain:	Zurn #Z-521 3" heavy duty drain with sediment bucket, loose grate, dura-coated cast iron body, "Duresist" grate and deep seal trap and trap guard.
FD-3	Funnel Drain	Zurn #z1019 dura-coated cast iron combination funnel trap drain, complete with bronze bottom cleanout plug.
SD-1	Shower Drain:	Zurn #Z-415-4 2” cast iron drain with chrome-plated bronze square top. Drain to have deep seal P-trap. Provide Pro Vent systems Proset trap guard in all SD-1 shower drains.
FS-1	Floor Sink:	Zurn ZN-1900-2" sanitor floor sink with 12" x 12" square top, full removable grate with center opening. N.B. dome, sani-coated exterior, acid resistant enamel interior, and Z-100 deep seal trap. Sink shall be complete with full grate, 3/4 grate, 1/2 grate, etc. as necessary to match application. Sink to be installed flush with floor.
FS-2	Floor Sink:	Zurn ZN-1900-3" sanitor floor sink with 12" x 12" square top, full removable grate with center opening. N.B. dome, sani-coated exterior, acid resistant enamel interior, and Z-100 deep seal trap. Sink shall be complete with full grate, 3/4 grate, 1/2 grate, etc. as necessary to match application. Sink to be installed flush with floor.
HD-1	Hopper Drain:	Zurn #Z662 4" diameter 16" x 16" dura coated C.I. hopper drain with grate. Provide deep seal P-trap.
DS-1	Dome Strainer	Zurn Z-415-6G 4” cornice drain in bottom of kitchen trench drain with bronze dome strainer, clamping collar, D.C. cast iron body. Cast 12" x 14" #4 lead sheet at trench drain outlets and clamp in solid.
TD-1	Trench Drain:	Polycast Series 600 precast polymer concrete pre-sloped drain system with #DG0641 cast iron grating and #DG0642B grating hold-down devices. Drain shall be drilled for 3" outlet with deep seal trap. See plan for length.
TP-1	Trap Primer	PPP Inc. Model MPB-500 electronic trap primer, 1/2" inlet and outlet, 1" air gap fitting, solenoid valve and timer with override button, 120/1/60. Unit assembly shall be complete in NEMA #1 metal box with access door. Provide distribution unit as required with number of outlets as required by plans.
RD-1	Roof Drain:	J. R. Smith #1010-ARC. Roof drains shall be cast iron type with flashing collar, C.I. dome, gravel guard, sump receiver, and underdeck clamp. See plans for sizes.
RD-2	Roof Drain: (Secondary)	J. R. Smith #1080-ARC w/2" water dam, duco cast iron body with combined flashing clamp and gravel stop with underdeck clamp, sump receiver, and cast iron dome. See plans for sizes.
DN-1	Downspout Nozzle:	Smith #1770 brass downspout nozzle. Provide 1/4" mesh aluminized, slip-fit bird-screen. See plans for sizes.

GI-1	Grease Interceptor:	Furnish and install the 1200 gallon two-cell grease interceptor shown on the drawings. Settling tank shall conform to Plumbing Code requirements, including latest revisions. Pre-cast reinforced concrete walls shall be poured continuous with floor. Provide heavy steel manhole covers on inlet and outlet basins for service and maintenance. Frames and cover to be treated with a corrosion resistant coating.
SM-1	Sampling Manhole:	Precast concrete manhole with dimensions shown on plans. See plans for waste connections size.

2.6 WH-1 thru WH-3 (Water Heaters)

A. Water heaters shall be natural gas fired high efficiency, packaged type, 199,000 BTUH input, 597 gallon per hour recovery thru 40°F. temp rise. Heater shall be 100-gallon factory installed ASME hot water storage tank with glass lined tank, power burner. Heater shall be suitable for PVC venting, complete with T&P relief valve, gas train, factory wired and tested upper and lower limit operation thermostats, combination high- and low-pressure safety controls, low water cut-off, and all controls for automatic operation. Set at 140° F. Provide PVC vent termination kit for roof installation. Manufactured by AO Smith, Bradford White, Larrs or PVI.

2.7 EX-1 thru EX-3 (Expansion Tanks)

A. Furnish bladder type expansion tanks suitable for domestic water. ASME steel shell construction. Provide heavy butyl diaphragm. Factory charge with air as per schedule. Manufactured by Bell & Gossett, Amtrol, or Taco.

2.8 CP-1 thru CP-2 (Circ Pumps)

A. Furnish and install the circulators shown and specified on the drawings. Circulators shall be of the in-line, pipe-mounted, motor driven, centrifugal type. All motors shall operate at 1750 RPM. Circulators shall operate at high efficiency and shall have a quiet, vibrationless operation. Provide steel support for motor. All circulators to be all bronze construction. Manufactured by Bell & Gossett, Armstrong, Grundfos, or Taco.

2.9 WS-1 (Water Softener)

A. Provide as indicated a vertical pressure type water softening system complete with pressure vessel, control valve, softening resin and combination brine salt storage tank. The system shall be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment. All equipment and material will be supplied in compliance with the specifications as intended for a complete and operational system.

B. System specifications are based on Pacific Water Inc. Model No. WS300-956SM. This system shall be a simplex (single) meter initiated water softening system designed to remove mineral hardness from a known water source. The system will be capable of supplying 12,000 gallons of softened water between regenerations based on the influent total water listed below.

C. DESIGN PARAMETERS

1. 3.1 Influent Total Water Hardness 20 grains per gallon (gpg)
2. Influent Total Water Hardness 342 parts per million (ppm) or mg/l
3. Normal System Flow & Pressure Drop: 73 gpm @ 15 psi drop
4. Maximum System Flow & Pressure Drop: 94 gpm @ 25 psi drop
5. Backwash/Rinse Flow: 12 gpm

6. Operating Temperature Range: 40°–100°F
7. Operating Pressure Range (System): 30–120 psi
8. Electrical Requirements: 120 Volt, 60 Hz, 1 phase (receptacle required)

D. EQUIPMENT SPECIFICATIONS

1. MINERAL TANK

   a. The mineral tank shall be 24 inches in diameter. The height shall be 72 inches, sufficient to allow for proper freeboard space above the resin bed for adequate expansion of the resin during backwashing.

   b. Mineral Tank Construction: Mineral tank shall be manufactured of a polyethylene inner shell reinforced by a continuous roving FRP filament winding. The top opening will be 4”-8 UN threaded connection. The tank shall be rated for 150 psi maximum working pressure.

2. INTERNAL DISTRIBUTION

   a. The upper distribution system shall be of the basket diffuser type to dispense water laterally to avoid channeling within the resin bed.

   b. The lower distribution system shall be of the single point distributor type, constructed of non-corrosive materials and shall be designed to provide even flow distribution through the resin bed. The lower distribution system shall be embedded in a subfill of washed gravel to support the resin bed.

3. MAIN OPERATING VALVE

   a. The main operating control valve shall be of a top mount design constructed of lead free brass with 2.0 inch NPT inlet and outlet piping connections. The control valve shall operate using a hydraulically balanced piston, driven between a series of seals and spacers to actuate the various regeneration cycles. The control valve shall incorporate a self-adjusting flow regulator to control the rate of flow to the drain and prevent resin loss during backwash regardless of system pressure fluctuations between 30 and 120 psi. The unit shall be supplied so that the valve will allow automatic bypass of untreated water during regeneration.

   b. Control Valve Timer: The system shall be equipped with an electronic programmable regeneration controller that will accept pulses from the electronic water meter and initiate a regeneration cycle after the preset gallons have been used. The controller will control the overall operation of the water softening system. All cycle times shall be fully adjustable. The order of the regeneration cycles shall be adjustable as well as the ability to add or delete cycles from the regeneration program. The controller shall be capable of displaying the following information: The current system flow rate, peak flow rate, gallon totalizer, days since last regeneration, total days since start-up, number of regenerations since start-up and a 63 day water usage history.

4. WATER METER

   a. The meter body shall be constructed of stainless steel with 2.0” NPT pipe connections. It will be designed to allow ease of removal of the turbine for inspection without modification of the piping system.

5. EXCHANGE RESIN

    a. The ion exchange resin shall be virgin high capacity “standard mesh” and shall be stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock. Each cubic foot of resin will be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. The resin shall be solid, of proper particle size, (not more than 4% through 40 mesh U.S. standard screens, wet screening) and will contain no agglomerates, shells, plates, or other shapes that might interfere with the normal function of the water softener. The system shall include 10 cubic feet of ion exchange resin.

6. BRINE SYSTEM

    a. Provide a complete brine system consisting of a plastic tank, salt platform, brine well, an automatic brine valve and all necessary fittings for operation with the water softening system. The system shall consist of a combination brine measuring and salt storage tank with salt platform. The tank will be 30 inches in diameter x 50 inches in height. The brine tank will be equipped with a float operated non-corrosive field serviceable brine float valve for automatic control of brine withdrawal and fresh water refill.

7. ACCESSORIES (All Optional selections)

    a. Water test kits for hardness tests will be supplied.

    b. Pressure Gauges for hard water inlet and soft water outlet.

    c. Sampling Cocks for hard water inlet and soft water outlet.

    d. Vacuum Breaker for protecting Fiberglass tanks from vacuum.

E. INSTRUCTION: One complete set of operating and maintenance manuals shall be provided.

F. WARRANTY: A written warranty must be provided from the manufacturer of the water softener system covering workmanship and materials

G. MANUFACTURED BY: Culligan, Pacific, or Crossroads.

2.10 C-1 (Air Compressor)

A. Furnish and install complete the vertical 2-stage air compressor as per the drawing schedules, and accessories shown and specified on the plans and in the equipment schedule. Compressor shall be air cooled with pressure lubrication to all bearings, V-belt drive with guards, drive rated at 150% of rated horsepower, drip-proof induction motor, unit mounted starter, and pressure switch. Compressor shall be attached to an ASME steel storage tank complete with inlet, outlet, and automatic drain fitting. Assembly shall be complete with pressure regulator, intake filter silencer, high pressure safety controls, automatic drain valve, automatic controls, and all accessories required for a complete and operable system.

B. Air compressors and dryers to be Campbell Hausfeld, or prior approved equal of Quincy, or Ingersoll/Rand.

2.11 WST-1 (Welding station table)

A. See schedule on drawings. Manufactured by Thermco Instrument Corporation or approved equal.

2.12 Air Admit Valves

A. Air admittance valves shall be Maxi-Vent by Studor or approved equal.

B. Air admittance valve shall be complete with aluminum cover for exterior installation.

C. Warranty shall be 10 years.

2.13 Vacuum Breakers and Backflow Preventers

A. Vacuum breakers and backflow preventers shall comply with requirements of the Utah State Plumbing Code for the actual installed duty.

B. Vacuum breakers and backflow preventers shall be of the type, style, and arrangement approved by the Code.

C. All vacuum breakers and backflow preventers shall be installed with the necessary isolation valves and test cocks.

D. Backflow preventers shall be located at a maximum of 4' - 0" A.F.F. and shall be accessible for service. Backflow preventers shall have a water filter with a replaceable cartridge.

2.14 Gas Pressure Regulators

A. Furnish and install, as required, approved type gas pressure regulators in gas piping ahead of appliance and equipment. Regulators located outside of building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with approved cap screen. Approved manufacturers of gas regulators are Maxitrol, Fisher, and Reliance.

2.15 Kitchen Equipment

A. The plumbing contractor shall rough-in and make final connection to all kitchen equipment as noted on the drawings and/or as required by the equipment and manufacturer for a complete and operable installation.

B. Data shown on the drawings is for design equipment. This contractor will, prior to construction, be issued a kitchen equipment booklet of equipment actually being installed, and all rough-in and connection data shall be taken from this booklet.

C. This contractor shall provide all necessary valves, stops, unions, piping, etc. for a complete installation.

D. The refrigeration system for the kitchen refrigerator and freezer will be provided by the kitchen equipment supplier.

E. The plumbing contractor shall review the kitchen equipment drawings and specifications for miscellaneous items which are to be furnished and/or installed under plumbing division of the work.

2.16 Lead Pans and Flashings

A. This contractor shall furnish a 30" square 4# lead flashing with each roof drain, vent and/or pipe penetration of roof. Coordinate with roofing contractor.

B. All floor drains shall be fitted with clamping collar and waterproof membrane.

C. Membrane and lead waterproofing pans for shower stalls and built-up type custodial floor sinks shall be installed by plumbers so they are 100% watertight. Drains shall have clamping device which clamps drain to pans. There shall be a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened, there is a complete watertight seal.

D. Care should be taken not to clog weep holes. All pans will be tested by placing test plug in drain and filling with water overnight.

2.17 Seismic Gas Shut-off Valve

A. Valve shall be seismically activated type with positive shut-off seal and automatic non-creeping mechanism with manual reset and visual open-close indicator.

B. Valve shall be U.L. listed for natural gas use and meet Standards for Earthquake Activated Automatic Gas Shut-off Systems, Standard No. 12-23-1, and ANSI Z21.70 1981.

C. Shut-off shall activate within five seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of 0.3 G and a period of 0.4 seconds.

D. Positive seal shall be provided from -10 deg. F. to +150 deg. F. at 20 psi gas pressure.

E. Seismic shut-off valve shall be Koso Model 2" 3/4 HP or approved equal.

PART 3 – EXECUTION

3.1 PRODUCT HANDLING

A. Protection: Use all means necessary to protect plumbing materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

3.2 TESTING

A. Furnish all required personnel and equipment and make all tests required to receive the approval of the Owner and all agencies having jurisdiction.

3.3 CLEANING UP

A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

3.4 ROOF DRAIN LOCATIONS

A. This contractor shall review the architectural and structural drawings and shall field verify from actual job site conditions that the roof drains are located at the low points of the roof systems. Locations shown on the plumbing drawings are approximate. All low points on the roof shall have primary and secondary roof drains installed in them unless otherwise noted.

3.5 WATER CLOSET INSTALLATION

A. General: Install water closets as shown on the drawing and as follows:

1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
2. Additional wall plates shall be provided where each pipe extends through finished wall.
3. Two rubber or plastic seat bumpers with metal holders shall be provided and secured to the wainscot behind the fixture.
4. The centerline of the flush valve shall be on the centerline of the fixture, 39 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
5. Chrome plated pipe support shall be provided on the long flush pipe outlet and shall be secured rigidly to the wall with suitable anchors.
6. The backflow preventer for the flush valve shall be installed at the discharge of the valves.
7. The flush valve water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium plated spacer sleeve and wall flange.

3.6 URINAL INSTALLATION

A. General: Install urinals as shown on the drawing and as follows:

1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
2. Additional wall plates shall be provided where each pipe extends through finished wall.
3. The centerline of the flush valve for wall hung urinals shall be on the centerline of the fixture, 45 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
4. The centerline of the flush valve for handicap urinals shall be 40 inches or less above the finished floor.
5. The backflow preventer for flush valve shall be installed at the discharge of the valve.
6. The flush valve and the water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium-plated spacer sleeve and wall flange.
7. Provide Schedule 40 solid core PVC spool piece at urinal.

3.7 LAVATORY INSTALLATION

A. General: Install lavatories as shown on the drawings and as follows:

1. Lavatories for use by wheelchair handicapped shall be installed with a minimum rim height of 34", a minimum vertical clearance of 29" from floor, and a minimum clear knee recess of 30" in width and 20" in depth.
2. Trap on lavatory for use by wheelchair handicapped shall be installed so as to provide maximum clearance under bowl. Exposed waste, trap and hot water supply under lavatory shall be insulated an approved ADA insulation kit as required by sink manufacturer.
3. Mount lavatories as required by code and architectural elevations.

3.8 FIXTURE CONNECTIONS

A. Floor Mounted Water Closets and Service Sinks: Provide connections between soil pipes and floor connected water closets and service sinks made with cast-iron floor flanges.

B. Connection sizes shall be 4-inch for water closets and 3-inch for service sinks.

C. Floor flanges shall be slipped over the ends of the pipes and caulked in position.

D. Special short radius fittings shall be used where space does not permit the use of standard fittings below the flanges.

E. Setting Compounds and Gaskets: Provide watertight and gas tight seals between flanges and fixtures with plumbing-fixture-setting compound or manufacturer's standard non-asbestos gaskets.

F. Neither rubber gaskets nor putty shall be used in sealing connections.

3.9 FIXTURE SUPPORTS

A. Urinal Support: Provide urinal chair carriers consisting of a pair of cast iron feet bolted to or imbedded into the floor together with 1.66 inch outside diameter (minimum), steel tubular upright members, steel hanger support plate, and steel bearing plate connected to cast iron or steel adjustment sleeves and furnished with necessary bolts, nuts, washers, and chrome plated trim. Provide chair carrier that is fully concealed in the building construction and that supports the fixture in such a manner that no part of the fixture will be supported by the wall or the partition.

B. Lavatory Support: Provide lavatory chair carriers consisting of a pair of cast iron feet bolted to or imbedded into the floor together with 1.66 inch (minimum) steel tubular upright members, a horizontally adjustable alignment truss or tie rod at bottom and another at the top connected to cast iron or steel adjustment sleeves and painted cast iron or steel adjustment sleeves, and painted cast iron concealed arms.

3.10 INSTALLATION OF PRESSURE REDUCING VALVES

A. General: Install one or more pressure reducing valves on the main water line supplying plumbing fixtures.

1. Provide each pressure reducing valve with a gate valve and union on both the inlet and outlet connections.
2. A bypass one pipe size smaller than the main water line provided with a globe valve and union, shall be installed between the inlet and outlet sides of the pressure reducing valve assembly.
3. Pressure gauges shall be installed at the inlet and outlet connections to the pressure reducing valve assembly. Gauges shall have T-handle stops in their connections.

3.11 STRAINER INSTALLATION

A. General: Place strainers ahead of pressure reducing valves, automatic control valves, pumps, and elsewhere as indicated on the drawings or specified.

3.12 BACKFLOW PROTECTION VALVE INSTALLATION

A. General: The entire water distribution system shall be protected against contamination due to backflow from non-potable sources. Each connection to a fixture or an item of equipment shall be protected in accordance with the requirements of the International Plumbing Code.

B. Reduced Pressure Zone Backflow Preventer: Install a reduced pressure zone backflow preventer in the building water supply main to expansion tanks, condenser water systems, and boilers as shown on the drawings and/or as required by the local codes.

3.13 INSTALLATION OF PIPE SLEEVES

A. Basic Requirements: Install pipe sleeves as follows:

1. Pipe sleeves shall be provided for all pipes passing through walls, slabs on grade and floors. Sleeves may be omitted where pipes pass through exterior walls above ground to wall hydrants and downspout nozzles.
2. Sleeves for pipes passing through exterior walls and slabs on grade which do not have membrane waterproofing shall be of cast-iron or galvanized steel pipe or black steel pipe, Schedule 40.
3. Sleeves for pipes passing through exterior walls, slabs on grade and floors which are provided with membrane waterproofing shall be of threaded galvanized steel pipe fitted with companion flanges and arranged to secure membrane. Companion flanges shall be drilled and tapped in such a manner that bolting is effected from the outer (or upper) face only.
4. Sleeves for pipes passing through potentially wet floors that do not have membrane waterproofing such as in toilet rooms, cafeteria kitchens, serving areas, dishwashing rooms, utility cores, mechanical equipment rooms, and areas that are provided with fire protection sprinkler systems, shall be galvanized steel pipe, shall project 2 inches above the finished floors, and shall be caulked watertight.
5. Sleeves for pipes passing through all other floors and walls shall be constructed of galvanized or black steel pipe, standard weight.
6. Sleeves shall be built into the walls and floors as the work progresses.

3.14 INSTALLATION OF CLEANOUTS AND FERRULES

A. Riser Connection to Sewer or Drain: Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main. Cutting of millwork or supports will not be allowed.

B. Test Tees: Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.

C. Cover Plates: Where cleanouts or test tees occur on concealed pipes in finished rooms, they shall be provided with a 1/8-inch thick, machine finished, brass cover plate of sufficient diameter to cover the opening in the finished wall or partition. The cleanout plug shall have a solid head, tapped for a 1/4-inch brass screw to secure the cover plate. Where cleanout plugs extend beyond the wall finish, the cover plates shall be of machine finished brass and shall be only of sufficient depth to fit against the wall to cover plug. Cleanout cover plates shall be painted to match adjacent wall finish. Cutting of millwork or supports will not be allowed.

D. Cleanouts Plugs For Threaded Fittings: Cleanout plugs for threaded fittings shall be in accordance with ANSI B16.12. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4 inches; cleanout plugs for piping 4 inches and smaller shall be the same size as the pipe.

E. Cleanout Plugs For Hub-and-Spigot Fittings: Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with ANSI B16.12, except that plugs required to be flush with the floor shall have square countersunk heads in lieu of raised heads.

F. Cleanout Plugs For Copper Drainage Lines: Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

3.15 WATER PIPING INSTALLATION

A. General: Water piping shall be complete from service connection to all fixtures and equipment outlets. Sizes of pipes shall be as shown or specified.

B. Reaming: Ends of pipes and tubes shall be reamed before being made up.

C. Threaded Joints: Threaded joints shall be made up metal-to-metal, with a noncorrosive lubricant applied to the male thread only. Lampwick or other packing material shall not be used in making up threaded joints.

D. Chromium Plated Piping: Chromium plated piping shall be threaded and made up carefully, and not more than one full turn of thread shall be exposed beyond any fittings.

E. Long Screws and Bushings: Long screws and bushings (other than bushings cast in the sand) shall not be used on water piping.

F. Soldering: Ends of tubing and recesses of fittings to be soldered shall be thoroughly cleaned. Joints shall be assembled without binding. Solder shall penetrate fully and shall fill the joint completely. Joints shall be made using lead-free solder, as specified.

G. Joint Materials: All joint materials shall be free from oil, tar, and greasy substances, and shall be dry when placed in the joint. The material shall be handled with care to prevent contamination.

H. Copper Tubing: All copper tubing shall be free from cuts, dents or other surface damage at the time of final inspection. Damaged tubing shall be removed and replaced with new.

I. Copper Tube Anchoring: Horizontal runs of copper tubing over 50 feet in length shall be anchored to wall or floor construction. Anchors shall be located near the midpoints of the runs so as to force the expansion equally to the ends or in a direction where expansion can take place without excessive strain.

J. Swing Joints, Offsets, and Expansion Joints: Swing joints, offsets, and expansion joints shall be provided where necessary to accommodate expansion of piping, which will be approximately two inches in 100 feet of copper hot water piping.

K. Dielectric Couplings: Where non ferrous metal piping and zinc coated metal piping are joined, dezincification resistant brass (DZN) nipples, 6" minimum length, shall be provided.

L. Reducing Fittings: Where pipe sizes shown or specified differ from the connection sizes of meters, pumps, fixtures, outlets, and the like, reducing fittings shall be installed close to them.

M. Pipe Branches: Branches from water supply mains shall be taken from the top, bottom or side, using crossover fittings where required by structural or operating conditions.

N. Upfeed Hot Water Return: On upfeed hot water distribution systems for which return circulation piping is shown, a 1/2" circulation connection shall be made at a point on each riser just below the highest outlet connection. Provide branch circulation lines with gate valves near the valves on corresponding supply lines.

O. Downfeed Hot Water Supply: Each downfeed main for a hot water supply system shall be graded upward to the first branch connection, which shall be taken from the top of the main. Beyond the first connection the main shall grade downward, and all branch connections shall be taken from the bottom of the main. Connect a 1/2-inch circulating line to the bottom of each downfeed riser. Provide branch circuiting lines with gate valves in locations corresponding to the supply branch valve locations.

P. Grading: Hot water supply and hot water circulating lines shall be accurately and uniformly graded to avoid traps which might impede or destroy circulation. All lines shall be graded so as to facilitate drainage.

Q. Unions: Unions shall be installed near points of connection to each piece of equipment, and elsewhere as required for installation of piping, removal and replacement of regulating and control equipment and the like. Right and left couplings or nipples are prohibited.

R. Water Hammer Arresters: Water hammer arresters shall be provided where indicated on the drawings. Water hammer arresters shall be approved and installed in accordance with the requirements of PDI-WH201 and shall bear the PDI seal of approval.

S. Roughing: Roughing shall be provided for equipment furnished under other sections of the specifications. Where future extensions are indicated on the drawings, roughing shall extend to within the space to be served, and shall be valved, and capped or plugged.

T. Where future extensions are indicated on the drawings, roughing shall extend to within the space to be served, and shall be valved and capped or plugged.

U. All indirect waste piping exposed in kitchen shall be Type "M" copper. PVC or ABS piping will not be acceptable.

3.16 INSTALLATION OF VENTS THRU ROOF

A. All vents thru roof shall be installed a minimum of 10'-0" form any outdoor air intake. In addition, vents shall be installed a minimum of 4'-0" from any fire rated walls. See plans for fire rated wall locations.

SECTION 23 7000
HEATING / COOLING

PART 1 – GENERAL

1.1 SCOPE

A. The installation covers the furnishing and installing of chillers, boilers, air handlers, pumps, piping systems, and all necessary trim and specialties, etc., as specified and shown on drawings or as required to provide the complete heating and air conditioning systems shown on the drawings and specified herein.

1.2 PIPE

A. A complete and ample system of the following shall be installed as shown on the plans.

1. Heating Hot water system
2. Chilled water system
3. Snowmelt System

B. Piping shall be properly graded and supported to prevent water and air pockets from forming, and to insure noiseless circulation throughout the system.

C. Pipe guides, expansion joints, anchors, and other accessories shall be provided as shown and detailed on the plans.

D. Branches leading from the mains shall be taken off from the top or sides of the mains at 90 deg., except where otherwise directed. These branches shall be arranged with swing connections to accommodate expansion and contraction.

E. All mains reducing in size shall be reduced with eccentric reducing fittings, with top of pipe level for water.

F. Run all piping as high as possible.

G. All hot water and cold water piping above 2" shall be welded.

PART 2 – PRODUCTS

2.1 HOT WATER BOILERS: (ATMOSPHERIC)

A. Boiler Capacity: The hot water boiler shall be designed for 115 psig hot water. The maximum water temperature will be 200 deg. F.

B. The boiler shall have capacity as listed on the plans when fired with natural gas, 1000 BTU/cu.ft.

C. Electrical power available will be 120/1/60.

D. General Boiler Design: The hot water boiler shall be an all steel membrane wall water tube boiler. It shall be mounted on a heavy steel frame with integral forced draft burner and burner controls. The complete packaged boiler shall be approved as a unit by Underwriters' Laboratories and shall bear the Underwriters' label.

E. The hot water boiler shall be completely preassembled and fire tested at the factory. The unit shall be ready for immediately mounting on floor or simple foundation and ready for attachment of water, fuel, electrical and vent connections.

F. Boiler Shell: The boiler shell must be constructed in accordance with ASME Boiler Code and must receive authorized boiler inspection prior to shipment. A copy of the inspection report shall be furnished to the purchaser.

G. The hot water outlet connection shall be located on the top centerline of the boiler and the return tapping in the rear of the lower drum. The boiler shall be designed to rapidly mix the return water with the boiler water through jet induced circulation. A dip tube shall be included as an integral part of the hot water outlet.

H. Provide Low/High fire atmospheric gas burner.

I. Two lifting eyes must be located on the top of the boiler.

J. Rear refractory shall be contained in the formed rear access door which must unbolt for ease of entry and/or inspection.

K. The exhaust gas vent shall be located near the rear of the boiler on the top centerline.

L. Provide factory mounted automatic stack damper for each boiler.

M. Observation ports for the inspection of flame conditions shall be provided at each end of the boiler.

N. The boiler insulation shall consist of a 2-inch fiberglass blanket under a sectional preformed sheet metal lagging. This insulation must be readily removable and reinstalled, if required.

O. The entire boiler, base frame, and other components shall be factory-painted before shipment, using a hard-finish enamel.

P. Hot Water Boiler Trim: The following items shall be installed on the boiler:

1. A combination pressure-temperature gauge shall be mounted on the boiler.
2. Water relief valves shall be of a type and size to comply with code requirements.
3. Barometric damper.
4. A low water cutoff shall be mounted on the boiler.
5. Combination high limit and low limit controls.
6. Boilers shall conform to ASTM-CSD-1.

Q. All electrical equipment shall be in conformity with the Underwriters' Laboratories requirements. Oil, heat, and moisture resistant wire must be used throughout.

R. Shop Tests: The packaged boiler must receive factory tests to check the construction, controls, and operation of the unit. All tests may be witnessed by the purchaser, if desired.

S. Installation: Boiler shall be installed per Utah Labor Commission Division of Boiler & Elevator Safety Boiler & Pressure Vessel requirements.

T. Factory Start-Up: Boiler shall be furnished with factory start-up service. Start-up report on each boiler shall be forwarded to the Owner's representative and bound in the O & M manuals.

U. Boilers to be Rite, Bryan, or approved equal.

2.2 AIR COOLED CHILLERS

A. SUMMARY

1. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.

B. REFERENCES

1. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.

2. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

C. SUBMITTALS

1. Submit shop drawings and product data in accordance with the specifications.

2. Submittals shall include the following:

    a. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections

    b. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.

    c. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.

    d. Schematic diagram of control system indicating points for field interface/connection.

    e. Diagram shall fully delineate field and factory wiring.

    f. Installation and operating manuals.

D. QUALITY ASSURANCE

1. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.

2. Regulatory Requirements: Comply with the codes and standards specified.

3. Chiller manufacturer plant must be ISO Registered.

E. DELIVERY AND HANDLING

1. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

2. Comply with the manufacturer's instructions for rigging and handling equipment.

F. WARRANTY

1. Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period often (10) years from date of equipment start-up. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the warranty period. The warranty shall include loss of refrigerant due to leaks that develop in the chiller not caused by events such as vandalism or other abuse. The warranty shall cover the entire chiller, including all components that were provided as part of the original manufactured chiller, including parts and labor.

G. MAINTENANCE

1. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer’s instructions.

H. ACCEPTABLE MANUFACTURERS

1. Carrier, Daikin or approved equal.

I. UNIT DESCRIPTION

1. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of multiple hermetic trio scroll or rotary screw compressor sets), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
2. Chiller shall be functionally tested at the factory to ensure trouble free field operation

J. DESIGN REQUIREMENTS

1. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
2. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15 deg. F to 65 deg.F.
3. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
4. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 17%. Performance shall be in accordance with AHRI Standard 550/590.
5. Acoustics: Sound pressure level for the unit shall not exceed overall 64 dBA at 100% capacity when tested per AHRI Standard 370 at 30 ft. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet code requirement of 50 dBA at the property line of the school.

K. CHILLER COMPONENTS

1. Compressor

    a. The compressors shall be sealed hermetic, scroll type, or rotary screw type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.
    b. Provide power factor correction capacitors for each compressor in order to raise compressor power factor to 0.95 at standard rating conditions. Capacitors shall be housed in a separate NEMA 3R rated enclosure and shall having fusing to protect the capacitors from over current. Fuse indicator lights shall be provided to provide visual indication that a fuse has blown.

2. Evaporator

    a. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger with factory strainer consisting of parallel stainless steel plates.
    b. The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

c. The water-side maximum design pressure shall be rated at a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

3. Condenser

a. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall have permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive. Each fan section shall be partitioned to avoid cross circulation.

b. Coil shall be microchannel, or similar design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

4. Refrigerant Circuit

a. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

L. Construction

1. Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel. Painted parts shall be able to meet ASTM B117, 1000-hour salt spray test.

2. Upper and lower section of unit shall have protective and decorative louvers covering the coils and unit end and have painted steel wraps enclosing the coil end sections and piping.

M. Control System

1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.

2. System shall include a single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

N. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:

2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

3. Shutdown Alarms

    a. No evaporator water flow (auto-restart)
    b. Sensor failures
    c. Low evaporator pressure
    d. Evaporator freeze protection
    e. High condenser pressure
    f. Outside ambient temperature (auto-restart)
    g. Motor protection system
    h. Phase voltage protection

4. Limit Alarms

    a. Condenser pressure stage down, unloads unit at high discharge pressures.
    b. Low ambient lockout, shuts off unit at low ambient temperatures.
    c. Low evaporator pressure hold, holds stage #1 until pressure rises.
    d. Low evaporator pressure unload, shuts off one compressor.

5. Unit Enable Section

    a. Enables unit operation from either local keypad, digital input, or BAS

6. Unit Mode Selection

    a. Selects standard cooling, glycol, or test operation mode

7. Analog Inputs:

    a. Reset of leaving water temperature, 4-20 mA\
    b. Current Limit

8. Digital Inputs

    a. Unit off switch
    b. Remote start/stop
    c. Flow switch
    d. Motor protection

9. Digital Outputs

    a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared

b. Evaporator pump; field wired, starts pump when unit is set to start

10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

11. Building Automation System (BAS) Interface

    a. Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.

    b. BACnet MS/TP master (Clause 9)

    c. BACnet IP, (Annex J)

    d. BACnet ISO 8802-3, (Ethernet)

    e. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.

    f. For chillers communicating over a LONMARK network, the corresponding LONMARK external Interface File (XIF) shall be provided with the chiller submittal data.

    g. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

    h. The communication interface shall allow for showing proof of status for each compressor when the chiller is in operation.

    i. Manufacture to provide all access to cards, etc, as required by the BMS contractor.

O. Accessories:

1. The following are to be included:

    a. **Single point power connection to disconnect switch**

    b. 115-volt convenience outlet mounted in control panel

    c. Chiller enclosure shall be factory assembled of weatherproof vandal resistant construction with locking hinged access doors to compressor chamber and vandal resistant coil guards on the condenser coils.

    d. Chiller to be complete with full height louvered panel package to enclose entire unit with no change in unit capacity.

    e. Full compressor and condenser sound attenuation kit.

    f. Provide factory mounted disconnect.

2. The following accessories will be included:

    a. Chilled water flow switch to be factory installed.

    b. Factory mounted strainer at heat exchanger.

c. 115-volt convenience outlet mounted in control panel

P. Approved Manufacturers: The air-cooled chiller shall be manufactured by Carrier, or Daikin.

2.3 CUSTOM AIR HANDLING UNITS (INDOOR)

A. Provide custom built, factory fabricated air handling systems to meet the performance requirements shown on the equipment schedules. Unless otherwise noted each unit shall be complete with insulated casings, supply fans (in arrays where there are four or more), return/relief fans, VFDs as noted, internal spring type vibration isolation, seismic restraints for seismic zone D, outside air dampers, relief air dampers, insulation, drain pans, cooling coils, heat transfer coils and filter frames with media.

B. Units shall be furnished complete with factory start-up and one-year parts and labor warranty follow-up services.

C. Units shall have the heating, cooling, air delivery capacity, and nominal physical characteristics shown on the schedule.

D. The unit manufacturer shall provide initial factory start-up services for a period of not less than 16 hours on-site, plus a minimum of two follow-up site visits of not less than 2-hours on-site each.

E. Unit Casing:

1. Wall panels shall be constructed of structurally formed frame sections made of galvanized steel joined together by formed galvanized steel parts embedded into formed corner sections forming a rigid framework and panel system. Each panel shall be removable. Panels are double wall construction 4” thick constructed of a solid painted galvanized steel outer wall and solid galvanized steel inner wall. Outer wall shall be minimum 18 ga. galvanized steel. Inner wall shall be minimum 22 ga. galvanized steel. Inner line at cooling coil section shall be 22 ga. solid stainless steel. Insulation shall be 1-1/2” psf long strand fiberglass. Fill material shall be compressed within the panel cavity tightly against both walls and shall be arranged so that no voids exist and settling is prevented. All panels shall be constructed so they are removable for access to all internal components.

2. Optional panel construction:

   a. 3" panels with foam injection, R19 value minimum.

3. Floor construction shall be structural I-beam and channel framing with 12 ga. solid galvanized steel walk surface. Floor construction at the cooling coil section shall be 12 ga. solid stainless steel. The floor shall be sealed watertight, with 1" high sleeves for pipe and electrical penetrations. Both the inner and outer galvanized sheets shall be welded to the structural framing. Welds shall be ground. Maximum beam spacing shall be 18” on center with special members located to secure the fan base, coils, or other components. Fill material for the base shall be the same as for the wall panels except that material shall be minimum 4” thick, or as per optional panel construction. Structural framework shall support the unit casing and all components and shall be provided with integral lifting lugs.

4. Door panels shall be constructed identically to the wall panels. Doors shall be of the overlapping seal type, supplied with double continuous air/acoustic seal around the sill, jambs, and head. The latches shall be wedge lever type, minimum 2 per door. The hinges shall be heavy duty ball bearing offset type to allow seating of the double seal, minimum 3 per door. Doors shall have hold-open devices for maintenance.

5. All unit doors shall have heavy duty lock hasps on all compartments to allow owner to secure all unit access doors. In addition, locking hasps shall be provided for all unit access doors.

6. Provide (6) spare lock hasps for each unit.

7. Provide lifting eyes above fan motor for maintenance purposes.

8. Where indicated, a custom top supply plenum shall be included. Plenum is to be field measured before fabrication to include all necessary openings as shown on the drawings and clear all structural members. The plenum may be fabricated and installed in the field by the air handling unit manufacturer.

F. Supply fans: (Units with four or more fans shall be a fan array)

1. Performance ratings shall conform to AMCA Standard 205 (fan efficiency grade), 211 (air performance) and 311 (sound performance). Fans shall be tested in accordance with ANSI/AMCA Standard 210 (air performance) and 300 (sound performance) in an AMCA accredited laboratory. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air, and fan efficiency grade (FEG). Sound certification shall apply to both inlet and outlet sound power levels.

2. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area.

3. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA Standard 99.

4. Fans shall incorporate a non-overloading type backward inclined airfoil blade wheel.

5. A housing structure consisting of rigid, corrosion resistant, galvanized steel frame and exterior panels shall house the rotating assembly. The structure shall be capable of supporting multiple fan assemblies stacked upon one another and side-by-side without isolation between the independent units.

6. Fans shall be provided with a minimum of 2" acoustical insulation. Insulation shall be protected on the airstream side with a non-friable vapor barrier preventing insulation shedding for IAQ (indoor air quality).Galvanized, perforated steel shall be located on the airstream side of the vapor barrier providing additional protection without sacrificing air and sound performance. Rotating assemblies shall be internally isolated from the structural housing to achieve the least amount of transmitted vibration to the structure and/or air handling unit.

7. Motor pedestal and inlet panel shall be of reinforced, galvanized steel or enamel coated mild steel construction and integrated into a single, isolated assembly. Motor pedestal shall be designed to minimize vibration from the motor and wheel. The inlet panel shall incorporate a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. The inlet panel shall be isolated from the housing structure. Motors shall be provided with factory motor overload package with panel (motor overload box) for each tower.

8. Wheels shall have a non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Wheels shall have airfoil-shaped extruded

aluminum blades. All hollow blade wheels shall be continuously welded around all edges. Wheels shall have the optimum number of blades for the best sound quality. Wheel diameters shall be easily discernible by the fan size. All wheels shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204 or better.

9. Steel components shall be thoroughly degreased and deburred before application of a rust-preventative coating. All galvanized and aluminum components shall be unpainted.

10. All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

11. Fan Array: (Where units have four or more supply fans):

    1) The fan array manufacturer shall provide a complete system. All blank sections, fan septum components as required for end, top & bottom sections to fit existing plenum walls.

    2) The fans in the array shall be wired to the motor overload panel(s). Wiring shall be in minimum Seal-Tite conduit and where multiple conductors are run, they shall be grouped together in a single conduit or enclosed raceway.

    3) All fans shall be provided with a back-draft damper fitted to the downstream side of the fan.

12. AHU manufacturer shall be responsible to ensure that fans will perform at scheduled HP and ESP at both hot water, chilled water, economizer cfm.

13. The manufacturer shall guarantee the workmanship and materials for its fan for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first

14. Fans shall be Twin City, Cook, Penn-Barry or approved equal.

G. Return/Relief Fans:

1. Provide mixed flow type direct drive fans of the capacities shown on the fan schedule. All fans shall be licensed to bear the AMCA Certified Rating Seal for air performance in accordance with AMCA Standard 210-74. (optional direct drive SWSI will be accepted)

2. The blades and hub are to be die cast aluminum-silicon alloy. Efficient design is required for a uniform airflow along the entire blade surface from tip to root.

3. All hubs must have either a plated steel integrally molded hub insert or a bolted, machined, aluminum insert. All inserts must have straight bores. 5/8" and larger bores must have key and set screws.

4. Blades must be attached to the hub by a brass collar, with a set screw, sonicly inserted into the hub socket or the hub must grip the entire blade shank. The blades shall be individually adjustable over a range of not less than 20 deg. Blades will be adjustable when the fan is at rest, without removing the wheel from the shaft.

5. Casing shall be mild steel hot-dip galvanized after fabrication. Casing shall cover entire motor and impeller. Motor base shall be prepunched for multiple frames. Motor base supports shall be streamlined wire formed steel with welded pads bolted to panel. All assembly hardware must be corrosion resistant zinc plated.

6. Fans shall be Twin City, Cook, Penn-Barry or approved equal.

H. Coils:

1. All coils will be field piped by this contractor as detailed on plans.
2. All coil capacities, pressure drops, leaving air temperatures, and selection procedures shall be certified as complying with ARI Standard 410 and bear the ARI seal.
3. Coils shall have continuous .0075” aluminum plate fins or spiral wound aluminum fins. Tubes shall be seamless .035” copper tube.
4. Coils shall deliver rated capacity based on 30% propylene glycol solution with coil face velocities not exceeding 500 fpm.
5. Coil casing shall be minimum 16 gauge stainless steel continuous with formed end supports and top and bottom channels. Intermediate tube supports shall be the same material as the casing. When two or more cooling coils are furnished they shall have intermediate drain pans and drain channels to drain the condensate to the main drain pan without flooding the lower coils or passing through the air stream.
6. Coils shall have threaded male connection with all headers internal to unit casing. Access for piping connection shall be afforded by properly sized hole into the floor of the unit with a 1" high welded waterproof sleeve, and tagged appropriately as hot and chilled supply and return.
7. Coils shall be proof-tested at 300 psig and leak tested at 200 psig air pressure under water.
8. Coils shall be designed working pressure of 200 psig and temperature of 220 degrees F.

I. Drain Pans:

1. Drain pans shall be constructed of 16 ga. 304 stainless steel. The drain pan shall be sloped toward the bottom of the coil and shall extend at least 12@ from the leaving air side of the coil and a minimum of 1-1/2@ deep. Drain pans shall be "V" shaped to drain outlet to insure a free draining pan for I.A.Q. All condensate piping shall be hard drawn copper tubing. Coil sections shall rest on 304 stainless steel feet attached to bottom drain and of sufficient gauge to support weight of entire coil assembly.

J. Filters:

1. Filters shall be U.L. Class 2 when tested in accordance with U.L. Standard 900. The 2-inch deep pleated filters shall have an average ASHRAE efficiency of 30% ASHRAE. The media shall be of non-woven cotton fibers with metal and support. Holding frames shall be welded rigidly in place with spring clips provided for filter retention.
2. Filters shall be the same size.
3. Filters shall be equipped with drip pans to drain away impacted snow melt. Pan construction shall be similar to the drain pans specified for cooling coils.
4. Unit manufacturer shall provide one (1) complete set of spare air filters for each unit provided. Filters shall be stored on-site as directed by owner.

K. Dampers:

1. Outside air, return air, relief air, and bypass dampers shall be parallel blade type with solid one-piece hexagonal shaft rotating in rustproof bushings requiring no lubrication.
2. Dampers shall be fitted with neoprene gasketing along the blade edges and rolled stainless steel jamb seals at the blade edges for low leakage. The leak rate shall not exceed 8 cfm/sq.ft at one-inch air pressure drops across the damper and four-inch lb/sq.ft. torque. Dampers shall be constructed to withstand 4" water column pressure (positive or negative). Blade orientation shall be such that at 50% position the outside air stream and the return air stream shall be directed toward each other for maximum mixing of the two air streams. Dampers shall be horizontal Tamco Air Foil type, Class I (no substitutions). No vertical damper will be accepted. Damper rods shall be a minimum of 1/2" hexagonal or octagonal shaft.
3. Optional dampers meeting performance of the specified 'Tamco' damper may be reviewed by engineer to determine equal performance and function prior bidding.

L. Damper Operators:

1. Damper operators shall be oversized to insure full range damper modulation without overpowering the operator. All damper operators and components shall be external for service. Dampers operators shall be Belimo (no exceptions).

M. Drives:

1. Provide fixed pitch pulleys and belt drives. Belts shall be designed for a minimum 1.5 safety factor. The base shall be constructed to allow adjustments of belt tension without having to loosen motor hold-down bolts. Belt drives shall OSHA safety guards.

N. Motors:

1. Motors for belt driven fans shall be factory mounted directly above the fan housing, internal to the unit. The supply and return motors shall be single winding - single speed and shall operate at 1800 rpm. Motor shall be rated for operation via a VFD. Each motor shall be mounted to an adjustable base rigidly supported to the fan housing with "lock-down" feature Motor shall have an extended shaft to accommodate the fixed pitch motor sheaves specified herein. Motors shall be of the same manufacturer as the inverter drive for units with adjustable speed fan drive controller.
2. Fan motor shall be sized to drive the fan taking into account inertial start-up torque and belt losses. (Use 3% to account for belt losses as a minimum). Whenever starting requirements exceed operating requirements, the motor shall be large enough to start the fan without overheating.
3. As a minimum motor shall be sized at 120% of design BHP requirements.
4. No motor shall operate within the service factor range. Motor rpm shall not exceed 1800 rpm.
5. Motor shall be mounted on an adjustable mount furnished with the unit.
6. Motor shall be of the premium efficiency type. Motors shall be Toshiba-Houston, Reliance Electric, or Westinghouse.

O. VFDs:

1. All unit required VFDs shall be provided with the unit. See drawing details and VFD specification.

P. Electrical Wiring:

1. An electrical chase shall be included in the unit and shall contain but is not limited to the 460V and 120V power connection points, motor overload box, VFDs, individual disconnects, DDC controller.
2. Unit disconnect handle shall be mounted external on electrical section of unit.
3. Fan motors, motor overload boxes, and VFD's shall be wired internally by the air handling unit manufacturer and terminate at a distribution bus in the central electrical chase internal to unit to provide a single point connection from Division 26.
4. All units shall be complete with local light switches for each service plenum and one exterior duplex GFI power outlet. The 120/1/60 circuit for basin pump, LED lights, and GFI shall be run separate back to electrical chase internal to unit for single point connection by Division 26.
5. Wiring shall meet the National Electric Code and Division 26 requirements. All wiring shall be run in 3/4" (minimum) conduit.
6. Unit compartment lights shall be LED type.

Q. Duct Smoke Detectors:

1. Duct smoke detectors for all units shall be provided by Division 26 and installed by ATC and/or sheet metal contractors under Division 23. Duct smoke detector shall be installed at return air inlet of unit.

R. Controls:

1. All controls will be furnished and installed in the field by the installing ATC contractor. See 25 1000 for requirements

S. Provide an integral extruded aluminum, galvanized, or painted and bolted or welded filter retainer frames for the specified Type "A" filters unless otherwise specified. Frame shall be suitable to accommodate the specified filters at maximum filter face velocity of 500 fpm. Filter media for the air handling units shall be as specified.

T. ‘Shop Drawings shall indicate specifically that the construction, fabrication, etc., of the units to be furnished comply with these Specifications.

U. Dimensions for air handling units shall be coordinated with job conditions.

V. The Owner and Engineer may, upon written notice, observe the air handling units for this Project under manufacture at the factory prior to shipment. The Mechanical Contractor shall notify the Owner and Engineer in writing at least three (3) weeks prior to the first air handling unit production date.

W. Sound Ratings: Each air handling unit shall be constructed and shall operate for all conditions of air flow (including full load to 30% of full load air flow for each unit serving variable air volume systems). Sound rating required for the completed installation shall be achieved with the air handling unit equipped with factory installed internal sound attenuators if required to meet acoustical criteria hereinafter designed, constructed and installed with the room construction as indicated on the

Architectural and Structural Drawings for this Project and vibration isolation as indicated in these Specifications and on the Mechanical Drawings.

1. The air handling unit manufacturer shall conduct testing to demonstrate the acoustical performance of the air handling unit specified. The acoustical measurements shall be made with a one-third octave band or octave band analyzer and w/the unit operating at 100%, 75%, 50%, 35% and 20% of design air flow capacity.

ACOUSTICAL PERFORMANCE: Sound Power Level @ 10 E-12 Watts

BAND	63	125	250	500	1000	2000	4000	8000
Absorp Coefficient of Panel		.89	1.20	1.16	1.09	1.01	1.03	.93
Transmission Loss of Panel	26	23	30	42	51	59	58	58
Fan Sound Data: (DB)								
(Intake)	73	80	84	83	82	78	72	66
At Discharge Opening	95	96	95	92	92	89	86	79

2. Indoor Custom Air Handling Units shall be: Unitech, Temtrol Custom, Scott Springfield, or Haakon.

2.4 CUSTOM BUILT ROOFTOP AIR HANDLING UNITS (OUTDOOR)

A. Provide custom built, factory fabricated air handling systems to meet the performance requirements shown on the equipment schedules. Unless otherwise noted each unit shall be complete with weatherproof casings, supply fans (in arrays where there are four or more), return/relief fans, VFDs as noted, internal spring type vibration isolation, seismic restraints for seismic zone D, outside air dampers, relief air dampers, insulation, drain pans,, cooling coils, heating coils, and filter frames with media.

B. Units shall be furnished complete with factory start-up and one-year parts and labor warranty follow-up services.

C. Units shall have the heating, cooling, and air delivery capacity, and nominal physical characteristics shown on the schedule.

D. The unit manufacturer shall provide initial factory start-up services for a period of not less than 16 hours on-site, plus a minimum of two follow-up site visits of not less than 2-hours on-site each.

E. Unit Casing:

1. Wall panels shall employ the pinder post construction method and shall be constructed of structurally formed frame sections made of galvanized steel joined together by formed galvanized steel parts embedded into formed corner sections forming a rigid framework and panel system. Each panel shall be removable. Panels are double wall construction 4” thick constructed of a solid painted galvanized steel outer wall and solid galvanized steel inner wall. Outer wall shall be minimum 18 ga. galvanized steel. Inner wall shall be minimum 22 ga. galvanized steel. Inner line at cooling coil section shall be 22 ga. solid stainless steel. Insulation shall be 1-1/2” psf long strand fiberglass. Fill material shall be compressed within the panel cavity tightly against both walls and shall be arranged so that no voids exist and settling is prevented. All panels shall be constructed so they are removable for access to all internal components.

2. Optional panel construction:

a. 3" panels with foam injection, R19 value minimum.

3. Floor construction shall be structural I-beam and channel framing with 12 ga. Solid galvanized steel walk surface. Floor construction at the cooling coil section shall be 12 ga. solid stainless steel. The floor shall be sealed watertight, with 1" high sleeves for pipe and electrical penetrations. Both the inner and outer galvanized sheets shall be welded to the structural framing. Welds shall be ground. Maximum beam spacing shall be 18” on center with special members located to secure the fan base, coils, or other components. Fill material for the base shall be the same as for the wall panels except that material shall be minimum 4” thick. Structural framework shall support the unit casing and all components and shall be provided with integral lifting lugs.
4. Removable, traffic rated grates shall be provided for the supply and return air openings.
5. Roof panels shall slope to one side for drainage with drip ledges. Panel construction shall be identical to wall panels.
6. Door panels shall be constructed identically to the wall panels. Doors shall be of the overlapping seal type, supplied with double continuous air/acoustic seal around the sill, jambs, and head. The latches shall be wedge lever type, minimum 2 per door. The hinges shall be heavy duty ball bearing offset type to allow seating of the double seal, minimum 3 per door. Doors shall have hold-open devices for maintenance.
7. All access doors shall have rain gutters above to reduce water penetration at doors seals.
8. All unit doors shall have heavy duty lock hasps on all compartments to allow owner to secure all unit access doors. In addition, locking hasps shall be provided for all unit access doors.
9. Provide (6) spare lock hasps for each unit.
10. Provide integral pipe chases for heating hot water and chilled water piping and valves to be contained within the unit and be fed from beneath the unit.
11. Provide rain hood for all outside air intake – 500 FPM max.
12. Provide factory roof curb. Curb must be of a height to allow installation of unit to be a minimum of 12" above finished roof elevation at low point of unit.
13. Unit custom powder coat color and finish.

    a. Paint coating: Factory applied 2-part epoxy, 3-4 mil thick with ASTM B-117 3500 hour salt spray test with custom color.

    b. Unit custom color and finish shall be selected by Owner. Manufacturer shall provide to the Architect a 2’-0” X 2’-0” custom powder-coated sheet metal panel or accepted alternate paint method of selected custom color to review for final approval.

14. Provide lifting eyes above fan motor for maintenance purposes.
15. The air handling unit shall be shipped fully assembled.

F. Supply fans: (Units with four or more fans shall be a fan array)

1. Performance ratings shall conform to AMCA Standard 205 (fan efficiency grade), 211 (air performance) and 311 (sound performance). Fans shall be tested in accordance with ANSI/AMCA Standard 210 (air performance) and 300 (sound performance) in an AMCA accredited laboratory. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air, and fan efficiency grade (FEG). Sound certification shall apply to both inlet and outlet sound power levels.

2. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area.

3. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA Standard 99.

4. Fans shall incorporate a non-overloading type backward inclined airfoil blade wheel.

5. A housing structure consisting of rigid, corrosion resistant, galvanized steel frame and exterior panels shall house the rotating assembly. The structure shall be capable of supporting multiple fan assemblies stacked upon one another and side-by-side without isolation between the independent units.

6. Fans shall be provided with a minimum of 2" acoustical insulation. Insulation shall be protected on the airstream side with a non-friable vapor barrier preventing insulation shedding for IAQ (indoor air quality).Galvanized, perforated steel shall be located on the airstream side of the vapor barrier providing additional protection without sacrificing air and sound performance. Rotating assemblies shall be internally isolated from the structural housing to achieve the least amount of transmitted vibration to the structure and/or air handling unit.

7. Motor pedestal and inlet panel shall be of reinforced, galvanized steel or enamel coated mild steel construction and integrated into a single, isolated assembly. Motor pedestal shall be designed to minimize vibration from the motor and wheel. The inlet panel shall incorporate a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. The inlet panel shall be isolated from the housing structure. Motors shall be provided with factory motor overload package with panel (motor overload box) for each tower.

8. Wheels shall have a non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Wheels shall have airfoil-shaped extruded aluminum blades. All hollow blade wheels shall be continuously welded around all edges. Wheels shall have the optimum number of blades for the best sound quality. Wheel diameters shall be easily discernible by the fan size. All wheels shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204 or better.

9. Steel components shall be thoroughly degreased and deburred before application of a rust-preventative coating. All galvanized and aluminum components shall be unpainted.

10. All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

11. Fan Array: (Where units have four or more supply fans):

    1) The fan array manufacturer shall provide a complete system. All blank sections, fan septum components as required for end, top & bottom sections to fit existing plenum walls.

2) The fans in the array shall be wired to the motor overload panel(s). Wiring shall be in minimum Seal-Tite conduit and where multiple conductors are run, they shall be grouped together in a single conduit or enclosed raceway.

3) All fans shall be provided with a back-draft damper fitted to the downstream side of the fan.

12. AHU manufacturer shall be responsible to ensure that fans will perform at scheduled HP and ESP at both hot water, chilled water, economizer cfm.

13. The manufacturer shall guarantee the workmanship and materials for its fan for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first

14. Fans shall be Twin City, Cook, Penn-Barry or approved equal.

G. Return/Relief Fans:

1. Provide mixed flow type direct drive fans of the capacities shown on the fan schedule. All fans shall be licensed to bear the AMCA Certified Rating Seal for air performance in accordance with AMCA Standard 210-74. (optional direct drive SWSI will be accepted)

2. The blades and hub are to be die cast aluminum-silicon alloy. Efficient design is required for a uniform airflow along the entire blade surface from tip to root.

3. All hubs must have either a plated steel integrally molded hub insert or a bolted, machined, aluminum insert. All inserts must have straight bores. 5/8" and larger bores must have key and set screws.

4. Blades must be attached to the hub by a brass collar, with a set screw, sonicly inserted into the hub socket or the hub must grip the entire blade shank. The blades shall be individually adjustable over a range of not less than 20 deg. Blades will be adjustable when the fan is at rest, without removing the wheel from the shaft.

5. Casing shall be mild steel hot-dip galvanized after fabrication. Casing shall cover entire motor and impeller. Motor base shall be prepunched for multiple frames. Motor base supports shall be streamlined wire formed steel with welded pads bolted to panel. All assembly hardware must be corrosion resistant zinc plated.

6. Fans shall be Twin City, Cook, Penn-Barry or approved equal.

H. Coils:

1. All coils will be field piped by this contractor as detailed on plans.

2. All coil capacities, pressure drops, leaving air temperatures, and selection procedures shall be certified as complying with ARI Standard 410 and bear the ARI seal.

3. Coils shall have continuous .0075” aluminum plate fins or spiral wound aluminum fins. Tubes shall be seamless .035” copper tube.

4. Coils shall deliver rated capacity based on 30% propylene glycol solution with coil face velocities not exceeding 500 fpm.

5. Coil casing shall be minimum 16 gauge stainless steel continuous with formed end supports and top and bottom channels. Intermediate tube supports shall be the same material as the casing. When two or more cooling coils are furnished they shall have intermediate drain pans and drain channels to drain the condensate to the main drain pan without flooding the lower coils or passing through the air stream.

6. Coils shall have threaded male connection with all headers internal to unit casing. Access for piping connection shall be afforded by properly sized hole into the floor of the unit with a 1" high welded waterproof sleeve, and tagged appropriately as hot and chilled supply and return.

7. Coils shall be proof-tested at 300 psig and leak tested at 200 psig air pressure under water.

8. Coils shall be designed working pressure of 200 psig and temperature of 220 degrees F.

I. Drain Pans:

1. Drain pans shall be constructed of 16 ga. 304 stainless steel. The drain pan shall be sloped toward the bottom of the coil and shall extend at least 12@ from the leaving air side of the coil and a minimum of 1-1/2@ deep. Drain pans shall be “V” shaped to drain outlet to insure a free draining pan for I.A.Q. All condensate piping shall be hard drawn copper tubing. Coil sections shall rest on 304 stainless steel feet attached to bottom drain and of sufficient gauge to support weight of entire coil assembly.

J. Filters

1. Filters shall be U.L. Class 2 when tested in accordance with U.L. Standard 900. The 2-inch deep pleated filters shall have an average ASHRAE efficiency of 30% ASHRAE. The media shall be of non-woven cotton fibers with metal and support. Holding frames shall be welded rigidly in place with spring clips provided for filter retention.

2. Filters shall be the same size.

3. Filters shall be equipped with drip pans to drain away impacted snow melt. Pan construction shall be similar to the drain pans specified for cooling coils.

4. Unit manufacturer shall provide one (1) complete set of spare air filters for each unit provided. Filters shall be stored on-site as directed by owner.

K. Dampers:

1. Outside air, return air, relief air, and bypass dampers shall be parallel blade type with solid one-piece hexagonal shaft rotating in rustproof bushings requiring no lubrication.

2. Dampers shall be fitted with neoprene gasketing along the blade edges and rolled stainless steel jamb seals at the blade edges for low leakage. The leak rate shall not exceed 8 cfm/sq.ft at one-inch air pressure drops across the damper and four-inch lb/sq.ft. torque. Dampers shall be constructed to withstand 4” water column pressure (positive or negative). Blade orientation shall be such that at 50% position the outside air stream and the return air stream shall be directed toward each other for maximum mixing of the two air streams. Dampers shall be horizontal Tamco Air Foil type, Class I (no substitutions). No vertical damper will be accepted. Damper rods shall be a minimum of 1/2” hexagonal or octagonal shaft.

3. Optional dampers meeting performance of the specified 'Tamco' damper may be reviewed by engineer to determine equal performance and function prior bidding.

L. Damper Operators:

1. Damper operators shall be oversized to insure full range damper modulation without overpowering the operator. All damper operators and components shall be external for service. Dampers operators shall be Belimo (no exceptions).

M. Air Intakes:

1. Air intakes shall have storm-proof louvers with intake hoods with birdscreens. Hood shall cover entire louver area. Louvers and hoods shall be sized for a maximum face velocity of 500 fpm, or as recommended by manufacturer.

N. Drives:

1. Provide fixed pitch pulleys and belt drives. Belts shall be designed for a minimum 1.5 safety factor. The base shall be constructed to allow adjustments of belt tension without having to loosen motor hold-down bolts. Belt drives shall OSHA safety guards.

O. Motors:

1. Motors for belt driven fans shall be factory mounted directly above the fan housing, internal to the unit. Motor shall be rated for operation via a VFD. Each motor shall be mounted to an adjustable base rigidly supported to the fan housing with "lock-down" feature. Motor shall have an extended shaft to accommodate the fixed pitch motor sheaves specified herein. Motors shall be of the same manufacturer as the inverter drive for units with adjustable speed fan drive controller.
2. Fan motor shall be sized to drive the fan taking into account inertial start-up torque and belt losses. (Use 3% to account for belt losses as a minimum). Whenever starting requirements exceed operating requirements, the motor shall be large enough to start the fan without overheating.
3. As a minimum motor shall be sized at 120% of design BHP requirements.
4. No motor shall operate within the service factor range. Motor rpm shall not exceed 1800 rpm.
5. Motor shall be mounted on an adjustable mount furnished with the unit.
6. Motor shall be of the premium efficiency type. Motors shall be Toshiba-Houston, Reliance Electric, or Westinghouse.

P. VFD Enclosure: Provide a weatherproof, ventilated enclosure inside unit to house VFDs.

Q. Electrical Wiring:

1. An electrical chase shall be included in the unit and shall contain but is not limited to the 460V and 120V power connection points, motor overload box, VFDs, individual disconnects, DDC controller.
2. Unit disconnect handle shall be mounted external on electrical section of unit.
3. Fan motors, motor overload boxes, and VFD's shall be wired internally by the air handling unit manufacturer and terminate at a distribution bus in the central electrical chase internal to unit to provide a single point connection from Division 26.
4. All units shall be complete with local light switches for each service plenum and one exterior duplex GFI power outlet. The 120/1/60 circuit for basin pump, LED lights, and GFI shall be run separate back to electrical chase internal to unit for single point connection by Division 26.
5. Wiring shall meet the National Electric Code and Division 26 requirements. All wiring shall be run in 3/4" (minimum) conduit.
6. Unit compartment lights shall be LED type.

R. Duct Smoke Detectors:

1. Duct smoke detectors for all units shall be provided by Division 26 and installed by the ATC contractor under Division 25 1000. Duct smoke detector shall be installed at return air inlet of unit.

S. Controls:

1. All controls will be furnished and installed in the field by the installing ATC contractor. See 25 1000 for requirements

T. Outdoor Rooftop Custom Air Handling Units shall be: Unitech, Temtrol Custom, Scott Springfield, or Haakon.

2.5 SNOWMELT SYSTEM

A. General: The system shall be complete installation consisting of pumps, expansion tanks, air separators, underslab tubing, manifolds, accessories, sensors, and all automatic control. Plumber shall coordinate with Snowmelt system supplier for all items to be field installed, piped, wired or connected and shall make allowances for such work in his bid.

B. Circulation Pumps:

1. All pumps shall be a maintenance-free, in-line, single stage, wet rotor type with the motor mounted directly to the pump volute. The pump models shall be furnished as shown on the plans and installed in accordance with the manufacture's recommendations. The pump shall be capable of delivering the capacities as indicated on the plan schedules and zone listing sheets.

2. The pump volute shall be constructed of cast iron, (closed systems), corrosion resistant 304 stainless steel (open systems) or bronze (open systems), and rated at 145 psi working pressure.

3. The impeller, impeller inlet cone, rotor can, and rotor cladding shall be constructed of stainless steel. The impeller for the circulators shall be 30% glass filled PES composite material. The impeller shall be secured directly to the motor shaft by means of a stainless steel split cone. The motor shaft shall be constructed of aluminum oxide ceramic and shall be supported by two radial bearings mounted in a stainless steel bearing plate and rotor can. The pump shall not have a coupling or mechanical seal.

4. The integral motor shall be rated at the horsepower indicated for continuous duty operating on voltage indicated on plans. The motor shall be cooled and lubricated by the pumped fluid and shall require no scheduled maintenance. The pump shall be UL listed and CSA approved. Furnish Grundfos Series UP circulators or approved equal.

C. Snowmelt System Controls:

1. Controller shall be a microprocessor-based control which activates and controls a hydronic Snow/Ice melting system based on return water temperature, the presence of snow/ice, slab temperature, water temperature drop across the slab and boiler water return temperature.

2. Slab sensor shall be rugged design to sit flush with the slab surface after being mounted into the sensor socket. The sensor shall measure the slab temperature, sensor surface temperature and sensor surface moisture level.

D. Snowmelt Distribution Pipe:

1. The heat distribution system shall be made of a Radiant Pex tube, for 1/2", 5/8", and 3/4" or for 3/8" products, single layer, cross linked polyethylene extrusion with an outer layer composed of an EVOH oxygen barrier. The tubing shall conform to the standard thermoplastic pipe dimension (SDR-9). Tubing shall contain a minimum cross-linkig value of 65% and no greater than 89%, inclusive. Tubing shall be warranted to 180 deg. F, in hydronic heating applications without detrimental effect.

2. The product shall be crush-proof, recovering its original cross sectional area after intermittent flattening due to construction, installation or site abuse.

3. 3/8" I.D. Radiant Pex shall be capable of being installed with a 4" radius, 180 deg. change of direction without cracking or collapsing. 1/2" I.D> Radiant Pex shall have a bend radius in the slab of 5", 5/8" I.D. Radiant Pex shall have a bend of 6", and 3/4" I.D. Radiant Pex shall have a bend radius of 7". Burst pressures shall not be less than 630 psi at 73.4 deg. F. Radiant Pex design and layout shall be as shown on plans, zone listing of as per approval of the mechanical engineer or the manufacturer's representative.

4. The heat distribution piping shall be certified by the manufacturer as permitting less than 0.1 mg oxygen/liter of fluid/day permeation transfer at 40 Deg. C.

E. Manifolds:

1. Manifolds shall be of type "L" hard copper body with brass branches and fittings. Energy transfer hose shall be affixed to the brass branches in accordance with manufacturer's written procedures and approved fittings. All installations shall be made in accordance with the manufacturer's current written installation procedures, using manufacturer's approved fittings. Heatway equipment shall have a manufacture's 20 year limited warranty for commercial/industrial applications.

2. Approved product: Radiant Pex, manufactured by Watts Radiant or approved equal.

3. Tie Straps: Nylon

4. Plastic Ball Valves: 87 psig cold working pressure (CWP), 140 deg. F. maximum operating temperature, full port design, chlorinated polyvinyl chloride (CPVC) body and ball, PTFE seats, EPDM seals, tee handle; threaded, socket, or unioin connections.

F. Installation:

1. Install piping and equipment as indicated, according to manufacturer's written instructions.

2. Run piping from manifolds without joints.

3. Install piping to concrete floor topping using nylon ties.

4. Install piping in concrete floors by tying to concrete reinforcing using tie straps.

5. Space piping according to manufacturer's recommendations and per approved working plans.

6. Install piping with bending radius not less than recommended by piping manufacturer.

7. Locate manifolds in accessible locations as indicated.

8. Flush with clean water. Clean strainers.

9. Fill system with 50 percent glycol/water solution.

G. System shall be Watts Radiant, Wirsbo or approve equal.

2.6 PLATE & FRAME HEAT EXCHANGERS (SNOWMELT)

A. Provide plate and frame heat exchanger plate. Shall be stainless steel alloy 316/alloy 304 suitable for 50% propylene glycol snowmelt systems. Counter current flow arrangement. Maximum working pressure 150 psi. Maximum working temperature 356 deg. F. ASME construction.

B. Manufacturer: Alfa Laval, Danfoss, B & G or Taco.

2.7 HOT WATER AND CHILLED WATER SPECIALTIES

A. Furnish and install complete the water specialties including all air vents, and specialty items required to provide a complete and operable hot and chilled water system.

B. Manual air vents shall be installed at all high points in the water system. Air vents shall be 3/8" ball valves and shall be installed on 1/2" nipple--6" long. Run 1/4" copper tube from vent to near floor--anchor tube securely to wall, pipe, or structural member.

2.8 WATER TREATMENT FOR HOT WATER & CHILLED WATER SYSTEMS

A. Contractor shall furnish and install chemical treatment of the chiller and boiler water system on initial start-up to prevent the formation of scale, corrosion, sludging, and carry-over. The chemical supplier shall analyze the raw water and prescribe the proper treatment formulation for the boiler system.

2.9 BASE MOUNTED PUMPS

A. Furnish and install the base mounted pumps of the size, type, and capacity indicated on the drawings.

B. All base-mounted pumps shall be single stage, non-overloading, centrifugal volute type. Impellers shall be bronze and shall be dynamically balanced. Bearings shall be of the ball or roller type and the shaft of stainless steel.

C. Pumps shall be provided with leakless mechanical shaft seal. All pumps shall be provided with flexible couplings which shall impose no restriction or normal end play or expansion. Each pump shall be provided with a cast iron or steel baseplate of ample size to hold both the pump and motor in alignment. Pumps and motor shall be aligned when running at normal temperature. Final alignment shall be made immediately prior to testing under the supervision of a representative of the pump manufacturer. All pumps shall operate at 1750 RPM. Motors shall be phase and voltage specified on plans, horizontal ball bearing, drip-proof. Pumps shall be designed in accordance with the standards of the Hydraulic Institute, including the latest modifications.

D. Non-Overloading: Motor brake horsepower shall not be exceeded at any point of the pump characteristic curve.

E. Rising Curve: Pump characteristic curve shall rise continuously from maximum capacity to shut-off, with shut-off head minimum 10 percent greater than the design head, except for double suction pumps to shut-off head shall be 20 percent greater than design head.

F. Working Pressure: Construct pumps for the working pressure in pounds per square inch specified or indicated. Factory test at 1.5 times working pressure.

G. High points of pump casing shall be provided with air vent cocks. Cocks shall be extended outside of insulation specified.

H. Premium efficiency motors shall be based on CEE premium efficiency criteria for OPD motors at 1800 RPM.

HORSEPOWER	NEMA PREMIUM EFFICIENCY
5	89.5%
7.5	91.0%
10	91.7%
15	93.0%
20	93.0%
25	93.6%
30	94.1%
40	94.1%
50	94.5%

I. Pumps shall be Armstrong, Bell & Gossett, or Taco.

2.10 PUMP SUCTION DIFFUSERS

A. Pump suction diffusers to match the system pipe size and pump inlet size shall be furnished and installed where shown on the drawings. Units shall consist of angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder.

B. Suction diffuser shall be Bell & Gossett, Armstrong or Taco.

2.11 IN LINE PUMPS:

A. In line pumps shall be of the electric motor driven type, of the capacities specified on the drawings.

B. Pumps shall be single stage, single suction, centrifugal type with hydraulically balanced impeller. All pumps shall be bronze fitted throughout with a cast iron casing and steel shaft. Pumps shall be provided with mechanical seals and pump and motor shall be direct connected or provided with a spring dampened coupling.

C. Pumps shall be Taco, Bell & Gossett, or Armstrong.

2.12 AIR SEPARATORS

A. Type: Provide air separators of tangential type constructed of steel and tested and stamped in accordance with section 8 of the ASME Codde for a working pressure of 125 psig.

B. Provide separators on hydronic systems capable of separating not less than 80 percent of the entrained air on the first passage of water and not less than 30 percent of residual air on each subsequent passage through the separator.

C. Provide flanged inlet and outlet connections, 3/4-inch diameter valve drain connection and 1-inch diameter top air eliminator connection.

D. Provide 1-inch diameter pipe from the top air eliminator point to a 5 gallon, steel, ASME stamped 125 pound working pressure air receiver vessel with automatic float vent.

E. Provide 1-inch diameter globe valve between the air separator and the air receiver.

F. Air separator shall be Bell & Gossett, Armstrong, Spirotherm, Taco or approved equal.

2.13 EXPANSION TANKS

A. Furnish and install pre-pressurized diaphragm-type expansion tanks of sizes indicated on the drawings.

B. Construct tanks of steel in accordance with section 8 of the ASME Code for a working pressure of 125 psig. Test and stamp tanks for the working pressure.

C. Support tanks on 2-inch diameter steel pipe legs with cross bracing and floor plates, bolted to a house keeping pad, or suspend on steel saddles with all-thread rod anchored to the structure.

D. The tanks shall be the product of a manufacturer who certifies that his tanks have been a standard production model for five years prior to opening bids and warrants the diaphragm material unconditionally, against failure or leakage for a period of five years from the date of project acceptance.

E. Expansion tank shall be Bell & Gossett, Armstrong, Flexcon, Amtrol, or Taco.

2.14 VARIABLE FREQUENCY DRIVES

A. Furnish and install complete with air handling units the variable frequency - variable speed motor drives for the various fans requiring variable speed controls.

B. Variable frequency drives shall be provided for the supply air fan motors and the return/relief air fan motors for all rooftop units and air handling units. Individual drives are required for each motor. Drives shall be mounted in unit by manufacturer. Coordinate location with electrical.

C. Additional Required Drives for various pumps are required depicted in the drawings. Coordinate with electrical.

D. Variable frequency drives shall be same manufacturer throughout project and shall be matched to the motor which they control by the V.F. drive manufacturer to insure maximum performance and minimum generation on both noise and electrical interference.

E. All V.F. drives shall be furnished with Auto/Off positions.

F. Factory start-up services shall be provided for all V.F. drive systems. A start-up report on each V.F. drive shall be included in the O & M manuals.

G. V.F. drives shall have integral current limiting devices.

H. V.F. drives shall not generate noise levels which are objectionable under normal operating conditions.

I. V.F. fan drives shall not excite the natural frequency of the fan/drive assembly, or otherwise create vibration related situations which are objectionable.

J. V.F. drives shall be internally protected against noise, or line transients, superimposed on the powerline.

K. All V.F. drives shall conform to IEE519 standard for level or harmonic filters.

L. Testing per IEE519 shall be performed and results and adjustments included in the project O & M Manuals.

M. Drives shall have the following features:

1. Input power requirements 480 VAC +/- 10, 60 Hz.
2. Output power requirement three phase 60 Hz.
3. Operating ambient temperature 32 deg. F to 104 deg. F.
4. Frequency stability - The output frequency shall not vary with load nor with any input frequency variation.

5. Speed Control - The output frequency shall be adjusted in proportion to a 3-15 psi signal input from the duct static pressure controller.
6. Start/Stop Control - The MCC starter shall start and stop the variable speed drive.
7. Indicating lights -
    a. Power on
    b. Zero speed
    c. Enabled
    d. Over temperature with alarm contacts
    e. Current limits
    f. Undervoltage with alarm contacts
    g. Overvoltage with alarm contacts
    h. Overcurrent with alarm contacts
    i. Driver module proper function leads (2 each module)
8. Speed reference signal - 0-5 VDC.
9. Protection circuits - Shut down shall occur for any of the following:
    a. Input voltage in excess of plus 12% of rated voltage.
    b. Input voltage in excess of -15% of rated voltage.
    c. CD bus voltage in excess of 1000 VDC.
    d. Output current rating excess.
    e. Loss of any one phase under full load.
    f. Internal temperatures of the control reach critical.
    g. A phase-to-phase short appears at the motor output terminals.
10. Automatic Restart - The controller shall automatically restart after a protective ciruit trip and the cause of the trip has cleared. The auto restart shall be attempted five times to restart the fan. If, after the 5th start the failure still exists, the controller shall remain off until manually reset and the trouble condition corrected. Each attempt shall begin at the zero speed and accelerate to the speed command signal input at a rate set by the acceleration current limit circuit.
11. NEC Requirement-
    a. A fused disconnect switch or MCP (furnished under Division 23) shall be installed in the vari-drive input power lines, rated for input voltage and current.
    b. The vari-drive shall be equipped with its own input fuse block section.
    c. Power wiring from the MCC starter to the vari-drive disconnect, from the disconnect to the vari-drive, and the from the vari-drive to the air handling unit or pump motor shall be wired per NEC, State, and local codes. Power wiring and conduit shall be furnished by the contract electrician under Division 26.

N. Drives shall be Mitsubishi, ABB or approved equal.

2.15 UNIT HEATERS

A. Furnish and install in the locations shown on the plans a propeller fan unit heater of the type and rating specified. Each unit to have capacity, air delivery, and motor characteristics as shown on the schedule and shall be for the duty as shown on the plans.

B. Unit heater coils shall be constructed of copper tubes with 0.035" thick walls, plate-type aluminum fins and steel headers. Tubes shall be expanded into the integral fin collars. The complete assembly shall be tested at 500 pounds hydrostatic pressure. Adequate provisions shall be made for expansion and contracting of coils within the casing.

C. Unit casings shall be of not less than 16 gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hard shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound. Heater design shall incorporate means for adequately cooling the motor when heat is on but the fan in not operating.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

F. Vertical delivery units shall be provided with the diffuser specified.

G. Unit heaters shall be Airtherm, Erincraft, or Modine.

2.16 HOT WATER BASEBOARD FINNED TUBE RADIATION

A. Furnish and install complete the enclosed hot water baseboard radiation shown on the drawings and specified herein.

B. Enclosures shall be fabricated of 16 gauge steel. They shall contain double formed "Z" flange at bottom edge of enclosure to fit se**c**urely into "Rota-Cam" lock slot of element and cover support. Special foot on cover supports shall hold cover firmly in slot without the use of screws or latches. Provide continuous full back panel at enclosure top. Louvers shall be provided for the full length of the enclosure. Where element is not used, provide blank enclosure.

C. Continuous turning, jam-proof dampers shall be provided at elements only. Damper shall have operating mechanism of sturdy screw-machine parts, designed so that overturning at fully opened or closed position will not cause damage. Knobs shall be knurled aluminum with Allen head retaining pin into damper shaft with open-closed directional arrows.

D. Provide neoprene gasket mounting on enclosure sleeves to complete wall to wall installation. Sleeves shall not overlap enclosure louvers.

E. Radiation elements shall be Rittling, Vulcan, Airtherm, or Sterling.

2.17 HOT WATER RADIANT HEATING PANELS

A. Radiant heating panels shall be constructed of 0.32" thick aluminum panels metallurgically bonded to 1/2" I.D. copper tubing @ 6" O.C. Panel shall be 1-1/2" thick 3/4 pound density insulation backing and a finish with a maximum UL test flame spread rating of 15, and no developed smoke.

B. Panels shall be furnished with all necessary mounting clips and brackets, and shall have pipe connection headers as shown on drawings.

C. Panel types shall be coordinated with the room finish schedules on the architectural drawings. Panel surface, color, and pattern shall match surrounding ceiling tile.

D. Panels shall be Sigma, Modine, Rittling or approved equal

PART 3 – EXECUTION

3.1 COORDINATION

A. All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.

B. Provide valves and unions or flanges at all pieces of equipment to allow maintenance.

C. Install all automatic valves, sensor well, flow switches, etc., as directed by the control contractor.

3.2 INSTALLATION OF CHILLERS

A. General: Install chillers in accordance with manufacturer's installation instructions. Install units plumb and level, in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install units on 4 inch high reinforced concrete pad, 6 inches larger on each side than chiller base. Cast anchor bolt inserts into the pad.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but no specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26.

D. Control: Coordinate field-installed automatic temperature control requirements with other sections of Division 25 1000.

E. All access codes shall be provided to ATC Contractor and Owner at no additional cost.

F. Manufacturer's Supervision: Chiller manufacturer shall supervise field assembly (if any) and installation of chiller work, with factory-trained technical service representative, for minimum of 2 working days. Prepare manufacturer's written report of installation, signed by representative.

1. Include leak testing, evacuation, dehydration, vacuum pumping, and charging in scope of supervision by manufacturer's representative.

2. Include lubrication, including filling of reservoirs, and confirming that lubricant is of quantity and type recommended by manufacturer in scope of supervision by manufacturer's representative.

3. Paint damaged and abraded factory finish with touch-up paint matching factory finish.

4. Grounding: Provide positive electrical equipment ground for chiller equipment and components where indicated.

G. Start-Up: Start-up chillers, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative.

1. Test controls and demonstrate compliance with requirements.

2. Replace damaged or malfunctioning controls and equipment.

3. Furnish sufficient refrigerant and dry nitrogen for pressure testing under manufacturer's supervision. Provide proper charge of refrigerant and oil.

H. Field test during chiller installation and start-up tests shall not be considered as fulfilling requirements of commissioning tests.

3.3 EXPANSION LOOPS

A. General: Provide expansion offsets where indicated on the drawings or where required to relieve excessive stress in piping systems.

B. Construction: Construct offsets with pipe and long turn factory-made welded fittings sized to limit the stress in any part of the loop or piping system to the values in ANSI B31.1. Use ASTM A 53 pipe and fittings.

3.4 INSTALLATION OF PUMPS

A. General: Install pumps where indicated and in accordance with manufacturer's published installation instructions.

B. Support: Install floor mounted pumps on minimum of 4-inch high concrete base. Provide anchor bolt inserts poured in place. Pumps shall be mounted with cap screws. Grout pump base level.

3.5 INSTALLATION OF ROOFTOP EQUIPMENT

A. All roof penetrations for the installation of equipment shall be located a minimum of 4'-0" from fire-rated walls. See plans for fire-rated wall locations.

B. All serviceable roof mounted mechanical equipment shall be located a minimum of 10'-0" from the edge of the building exterior walls.

3.6 INSTALLATION OF BOILERS

A. It is the Mechanical Contractor's responsibility to coordinate all requirements with the State Boiler Inspector to obtain plan review, permits and inspections prior to boiler start-up.

SECTION 23 8000
AIR DISTRIBUTION

PART 1 – GENERAL

1.1 SCOPE

A. In addition to all materials, equipment, and labor required to complete the systems shown on plans and specified herein work shall include:

1. Air distribution duct systems
2. Ventilation duct systems
3. Exhaust duct systems
4. Make-up air systems
5. Special duct systems.

PART 2 – PRODUCTS

2.1 SUMMARY

A. Construct all ducts, plenums, etc., of the gauges specified in the latest editions of the applicable SMACNA manuals, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots.

B. Duct construction and installation details shall comply with the latest edition of the SMACNA Duct Construction Standards.

C. Ducts from the fan unit discharge to VAV terminal boxes shall be constructed to meet the requirements of a +4 inch pressure class. All other supply air ducts shall be designed to meet the requirements for +2 inch pressurized ducts. All exhaust ducts shall be -2 inch suction ducts.

2.2 +4" PRESSURE CLASS DUCTWORK

A. All ductwork on the discharge side of Air distribution units to the terminal boxes shall be "+" pressure class duct. It is the essence of the duct system to have a minimum pressure loss. Therefore, ducts shall be run in a straight line and shall be run so that the lowest beam or obstruction shall generally determine the centerline of the straight run. Eccentric reducing transitions shall be avoided, but may be used where space is a determining factor. Bends and elbows other than those shown on the drawings shall have the approval of the Owner's representative before installation. No pipes, conduits, or any other obstructions shall be run through +4" P.C. ductwork.

2.3 ROUND DUCTWORK +4" PRESSURE CLASS

A. The round +4" P.C. HVAC ductwork, fittings, and accessories shall be factory fabricated, spiral conduit. Ductwork may, when approved by the owner's representative, be fabricated in a 26 ga. standing rib configuration. The ducts shall be constructed of rust-resistant zinc-coated steel and shall be of the sizes called for on the drawings. Approved manufactures include:

1. United Sheet Metal Company
2. Metco
3. Sheet Metal Products Co.
4. Everdur
5. Dees'
6. Ventline

B. All fittings in the round ducts shall be factory fabricated to match the spiral ducts and shall be of the same manufacturer. All fittings 3 inches to 36 inches shall be made of not lighter than 20-gauge zinc-coated steel, sizes 38 inches through 50 inches shall be 16-gauge with joints equal to Everdur.

C. Ninety-degree elbows shall be equal to United Sheet Metal Company Type E-5, five-piece construction with a centerline radius of 1-1/2 times the pipe diameter. See drawing detail for elbow construction.

D. Shop or job fabricating pipe and fittings will not be acceptable.

E. Pipe to pipe joints in diameters to 50 inches are by slip fit or by projecting collar of the fitting into the pipe.

F. Insertion length of sleeve coupling and fitting collar is 2 inches for diameters through 9 inches and 4 inches for diameters 10 inches through 50 inches.

G. Pipe-to-pipe and pipe-to-fitting connections in diameters above 50 inches are made by angle ring flanges. Connections 51 iches through 56 inches are made by the loose ring "Van Stone" flange; 1/2 inch flange is provided for the body ends of duct sections and fittings to act as a gasketing surface for sealing. The angle ring is a rolled welded ring to the following schedule:

Diameter	Size of Angle
37 thru 40 in.	1-1/2 x 1-1/2 x 3/16
41 thru 48 in.	2 x 2 x 3/16
Over 48 in.	2 x 2 x 1/4

H. Above 56 inches, the duct and fitting body is to welded to the angle ring flange. If the duct wall is flanged over the face of the angle ring, the welds can be intermittent welds of 1 inch in 4 inches. If not flanged over face, welding must be continuous. Metal flanging must be 1/2 inch minimum.

I. Bolt hole spacing for angle rings shall bot exceed 6 inches.

J. If duct sections in diameters greater than 50 inches are supplied in lengths greater than 4 ft. lengths, one angle ring must be welded to duct on 4-foot centers. Welding can be intermittent weld of 1 inch in 4 inches.

K. Round duct joints in diameters through 50 inches shall be sealed as follows:

1. Approved sealer equal to "Hard Cast" shall be applied to coupling and fittings. Sealer is applied to the outside of the joint, extending 1 inch on each side of the joint bead and covering all screw heads. Plastic backed tape is immediately applied over the wet sealer.
2. The duct sealer must be specifically formulated for the job sealing the field joints for high-pressure systems. The sealer shall be compatible with plastic-backed duct tape so the two shall cure and bond together. Samples of sealer and tape and the specification data sheets shall be submitted to the Owner's representative for approval.
3. Flanged joints shall be sealed by Neoprene Rubber Gaskets.

2.4 RECTANGULAR DUCTS +4" PRESSURE CLASS

A. The Schedule for rectangular sheet metal 4" P.C. duct construction is as follows:

US STD. GAUGE	MAX SIDE INCHES
22	Up to 12
20	13 to 30
18	41 to 60
16	61 to 90
14	91 & up

2.5 DUCTS BELOW SLABS

A. Underground ductwork, including fittings, shall be constructed of fiberglass-reinforced plastic and shall be installed in accordance with manufacturers specifications. All duct sections shall be joined by a galvanized sheet metal sleeve installed inside of duct and secured with sheet metal screws.

B. An extruded bead of Presstite No. 579.6 non-hardening waterproof mastic shall be applied to the end of one duct to be joined and other duct pressed tightly against bead and secured with screws. Wrap joint with Nashua No. AV1-10 or No. 357 waterproof tape covering screw heads.

C. Sheet metal boot shall be constructed of 20 ga. galvanized sheet metal with a 1-1.2" flange to fit against duct. Apply an extruded bead of Presstite No.579.6 mastic to duct and attach boot with self-tapping sheet metal screws, pulling boot flange snuge to duct surface compressing mastic. Tape joint securely with the Nashua Waterproof Tape, covering all screw heads. Encase boot completely in concrete, covering well around and below taped joint.

D. Duct shall be installed in a trench encased in concrete as detailed on drawings.

E. Duct shall meet the ICBO standards and shall comply with IMC for non-metallic ducts

F. Ducts and fittings shall be Spunstrand or approved equal.

2.6 SAWDUST COLLECTION DUCT

A. General: All exhaust systems shall be constructed with the materials recommended herewith and installed in a permanent and workmanlike manner. Interior of all ducts shall be smooth and free from obstructions with joints either welded or bonded with adhesive airtight.

B. Materials: Ducts shall be constructed of black iron welded or of galvanized sheet steel riveted and soldered (galvanized only on exterior ducts). Interior of all ducts shall be smooth and free from obstructions with joints, either welded or soldered airtight, as specified above.

C. The following metal thickness shall be supplied for all ducts:

Dia. of Straight Ducts	U.S. Standard Gauge for Steel Duct
Up to 8" dia.	22 gauge
8" to 18" dia.	20 gauge
Above 18” dia.	18 gauge

D. Elbows and angles shall be a minimum of two gauges heavier than straight lengths of equal diameter.

E. Where flexible piping is necessary, a non-collapsible type of flexible piping shall be used and it shall be kept at a minimum length.

F. Construction: Longitudinal joints of ducts shall be lapped and riveted or spot-welded on 3" centers maximum.

G. Girth joints of ducts shall be made with lap in direction of air flow, with 1" lap for diameters thru 19", and 1-1/4" lap for diameters over 19".

H. Elbows and angles should have an inside or throat radius of two pipe diameters whenever possible, but radius shall never be less than one pipe diameter. Large radii are recommended for heavy concentrations of highly abrasive ducts.

I. Construct elbows 6" or less in diameter of at least five sections, over 6" diameter of seven sections. Angles shall be pieced proportionately.

J. Duct subject to explosive forces from collector and fan to abort gate and no-return valve shall be of a gauge heavy enough to withstand the forces. See manufacturer's recommendations.

2.7 ACCESS DOORS AND PANELS

A. Location: Provide access doors in casings, plenums, and ducts where shown on the drawings and where specified for ready access to operating parts including fire dampers, smoke dampers, valves, and concealed coils.

B. Pressure Clarification: Construct and install access doors in accordance with SMACA Standards to suit the static pressure classifications and the locations where installed.

C. Access Doors in Ducts: Provide and size doors as follows:

1. Minimum 24-inch by 24-inch clear opening.
2. When field conditions require and access opening smaller than 16-inch by 12-inch, provide a 24-inch long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

D. Door Requirements: Provide doors in casings and duct as follows:

1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.
2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.
3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6-inch by 6-inch minimum size. Anchor port with structural metal frame, resilient gaskets and stainless steel bolts.
4. Hinges for doors in zinc coated or aluminum construction shall be steel or iron, zinc coated with brass pins.
5. Hinges for doors in copper, copper nickel alloy construction shall be all brass.

2.8 CLOSURE COLLARS

A. A duct ending at a wall or partition shall have the edge turned back to form a closure collar and flanged tight to the wall or partition so that no sharp or ragged edge appears.

2.9 EXPOSED ROUND +2" PRESSURE CLASS

A. All joints and fittings shall be sealed with thermo-fit duct band by Raychem or approved equal. Contractor shall take care to insure that all joints and fittings are near in appearance.

2.10 INSULATED DOUBLE WALL DUCTWORK

A. Round duct and fittings shall be 2" double wall with a perforated liner as noted on plans. Duct shall be United McGill Accousti-K-27 or equivalent.

2.11 FLASHING

A. Where ducts pierce roof construction, the flashing shall be provided as part of Division 7.

B. The equipment bases and duct opening bases on the roof shall be constructed by this Contractor as shown on the drawings. The base shall be constructed to fit the equipment approved for construction. This Contractor shall construct and install a weatherproof inverted pan over the wood bases to act as a counterflashing and weatherproof hood for the base. All openings through the pan for equipment mounting shall be sealed weathertight with lead washers.

2.12 TEST HOLES IN DUCTWORK

A. Test holes for testing air quantities in ducts shall be installed at locations to be specified by the Balancing Contractor. Rubber stoppers shall be provided for closing the test holes. Where these holes are installed in insulated ductwork, a removable plug of approved insulation material shall be provided. An instrument port shall be provided in the following locations for each fan system.

1. Return air shaft and/or duct upstream of sound traps
2. Return air fan plenum
3. Main return air duct upstream of fresh air dampers
4. Mixed air plenum
5. Supply fan plenum

B. Additional ports are to be installed in locations determined by the Owner's representative.

C. Instrument ports shall be die cast with screwed cover for the insulation thickness specified. Ports shall be located outside of the plenum with 20-gauge sheet metal sleeve of the same size as the port opening, passing through insulation where ducts have interior insulation.

2.13 ELBOWS

A. Elbows with radius to the center of the elbow at least 1.5 times the duct width shall be installed parallel to the radius or turning vanes. Square elbows may be used if they are provided with Duct turns. Single-blade duct turns with trailing edge shall be used in all square elbows. No short radius elbows shall be allowed in high-velocity ductwork.

2.14 CLEANOUT OPENINGS

A. Duct systems shall have cleanout openings equipped with tight fitting sheet metal doors. Doors shall be tightly latched without the use of tools.

2.15 FIRE-RESISTIVE ACCESS OPENING

A. When cleanout openings are located in ducts within a fire-resistive shaft or enclosure, access openings shall be provided in the shaft or enclosure at each cleanout point.

B. These access openings shall be equipped with tight-fitting sliding or hinged doors which are equal in fire-resistive protection to that of the shaft or enclosure.

2.16 CLEARANCES

A. Duct system shall have a clearance from combustible construction of not less than 18 inches. This clearance may be reduced to not less than three inches, provided the combustible material is protected with materials approved for one-hour fire-resistive construction on the duct side.

2.17 EXHAUST OUTLETS

A. Exhaust outlets shall extend thru the roof, unless otherwise noted. Such extension shall be a minimal of 24" above the roof surface, at least 10 feet from any adjacent building, property line, or air intake opening into any building, and shall be located at least 10 feet above the adjoining grade level.

B. Duct shall terminate in a Breidert type vent cap with birdscreen.

2.18 BRANCH TAKEOFFS

A. Branch takeoffs shall be as shown on the drawings, and shall be fitted with adjustable lock balancing dampers, complete with locking quadrants. Where dampers are not accessible for adjustment from above, Young No. 315 or Ventlok 666 concealed ceiling regulators with adjustable chrome-plated covers shall be provided.

B. H.E.T. duct branch fittings shall be fabricated from 26 ga. G.I. for fittings 8" dia. and smaller, and from 22 ga. G.I. for fittings larger than 8" dia. Fittings shall have attachment flange, and duct collar with locking quadrant balancing damper. Fittings shall be Precision Air, Genflex or Metals Mfg.

2.19 WALL PENETRATIONS

A. All ducts penetrating structural or architectural walls shall be sealed air and sound tight as specified in Section 23 0100, General Provisions and 23 0500, Basic Materials and Methods.

2.20 FIRE RATED SURFACE PENETRATIONS

A. All ducts penetrating fire rated surfaces shall be sealed as directed in 230900.

2.21 LOCKER & SHOWER EXHAUST

A. Exhaust ductwork above the lockers and showers shall be -2" pressure class. Concealed ductwork shall be wrapped with insulation to prevent condensation. Do not line.

B. Exposed exhaust ductwork shall be sealed and painted. Do not line or wrap.

2.22 CROSS BREAKING

A. Sheet metal ducts shall be cross broken on the four sides of each 4'-0" panel. All vertical and horzontal sheet metal barriers, duct offsets, elbows, as well as 4'-0" panels of straight sections of ducts, shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.

2.23 GREASE DUCT INSULATION WRAP

A. See Section 23 1800.

2.24 DUCTWORK

A. All ductwork shall be fabricated and installed in compliance with the latest SMACNA duct manuals.

B. Sheet metal ducts shall be properly braced and reinforced with and, where they protrude above roof, they shall be properly flashed. Internal ends of all slip joints shall be installed in direction of flow.

C. Underground ductwork and fittings shall be constructed of fiberglass reinforced plastic and shall be all requirements of the 2018 IMC and listed with ICC-ES for direct burial application.

1. All ducts and fittings shall bear labels indicating all code listings.
2. All field joints shall be watertight and constructed per duct manufacturer requirements.
3. Duct and fittings shall be sand bedded.

D. Curved elbows shall have certerline radius equal to 1-1/2 times the width of duct. Air turns shall be single thickness installed in abrupt elbows and shall consist of curved metal blades or vanes with extended trailing edges arranged so as to permit air to make abrupt turn without appreciable turbulence. Air tunrs shall be quiet and free from vibration when system is in operation. Double thickness turning vanes shall be used only where necessary to insure the structural integrity of duct system.

2.25 DUCT JOINTS

A. All ducts joints must be sealed airtight as required by Table 1-2 "SEAL CLASSIFICATION" of the "HVAC Duct Construction Manual". The term "seal" or "sealed" means use of mastic or mastic plus tape or gasketing as appropriate.

B. All transverse joints on metal rectangular ducts 30" and over and all exhaust ductwork 12" and larger shall be constructed using the Ductmate 4-Bolt Duct Connection System.

C. The system must be installed according to the manufacturer's instruction and assembly booklet.

D. The Ductmate system shall be comprised of a hollow, slip-on flange, containing a factory applied integral sealant and separate corner pieces to connect the two flanges to form a rectangular frame. This frame shall be affixed to the duct, and bolted together at the corners. Install a gasket between the flanges, and a support cleat to join the flanges on the outside.

E. The system components shall consist of:

1. Flange - 20 GA roll formed galvanized steel, containing an integral sealant.
2. Corner Piece - Stamped cold formed galvanized steel, bossed and stiffened.
3. Gasket - Closed cell neoprene, 5% max. shrinkage, 5% water absorption, self-extinguishing, zero burn rate.
4. Cleat - Steel or PVC construction, can be either snapped on, or driven over the joined flanges.
5. Nut and Bolt - Regular 3/8" x 1" stove bolt, one n/b connects two corner pieces, four n/b per joint.

2.26 DIMENSIONS

A. Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes shown on the drawings are free area inside dimensions. Acoustically-lined ducts shall have outside dimensions increased as required to accommodate the acoustic lining specified and still maintain the free area inside dimensions shown on the drawings.

B. Under no circumstances shall the cross section of any duct be decreased by dents, pipes, or hanger rods running through it unless otherwise indicated on the drawings. Neither shall the shape be changed without approval. No abrupt transitions that restrict the area shall be used. Where necessary to gain clearance, the duct seams may be turned inside. Structural and Architectural drawings shall be consulted for areas with restrictive clearances.

2.27 FIELD VERIFICATION

A. No ductwork shall be fabricated without first field verifying that the available space (under actual job conditions) will permit installation of the ductwork without structural or other conflicts.

2.28 FLEXIBLE CONNECTION

A. This contractor shall provide flexible connections not less than 4 inches wide, constructed of heavy, waterproof, woven plastic-coated glass fiber at the inlet and outlet connections of each fan unit, securely fastened to the unit and to the ductwork by a galvanized iron band, and provided with tightening screws. Corners shall be sewn tight shut.

2.29 +4" PRESSURE CLASS FLEXIBLE CONNECTIONS

A. This flexible connection between the +4" P.C. ductwork and VAV boxes or fans shall be fabricated of neoprene-coated 1/8 inch glass fabric sheets with the ends vulcanized together. The flexible connection shall be securely attached to the fan and ductwork with heavy iron draw bands. Connections shall be 30-ounce Ventglass.

2.30 VOLUME DAMPERS

A. Opposed-blade balancing dampers (OBD) to 12 inches by 36 inches: Dampers used in low-velocity branch ducts to control the volume of air flow shall be Young No. 820 or Air Devices volume control dampers. An operating head shall be locked in position by a set key where the damper is accessible. Where the damper is not accessible, a volume control damper, consisting of a coupling, 3/8 inch square shaft, and regulator for operating the unit from suspended ceiling shall be provided.

B. Opposed-blade balancing dampers (OBD) larger than 12 inches by 36 inches: Airolite type 902 opposed-blade damper of 16-gauge galvanized steel with locking quadrant shall be used or equal of Airolite, Ruskin, Louvers and Dampers, American Warming, or Dowco.

2.31 DAMPER REGULATORS

A. All volume dampers and splitter dampers in exposed ductwork shall be provided with Ventlock No. 640 or Young No. 443 damper regulators. Each volume damper and splitter damper concealed above an inaccessible ceiling, etc., shall be provided with a shaft extended thru the ceiling, to which shall be attached a chrome-plated Ventlock No. 666 concealed damper regulator. No. 680 Ventlock miter gears shall be used where necessary.

2.32 AIR FLOW MEASURING DEVICES

A. The sheet metal contractor shall install the air flow measuring devices as specified in

Section 23 9000. The devices will be furnished by the control contractor.

2.33 BELT GUARDS

A. Belt guards shall be fabricated and installed. Guards shall be constructed of 10-gauge wire, 1-inch mesh in 1-1/2 inch angle-iron welded frames. All guards shall be provided with an opening for a tachometer and shall be either the split type or easily removable for belt repair. The guards shall be anchored securely to the floor or walls to prevent any vibration.

2.34 DUCTS AT MASONRY

A. Where ducts are shown connecting to masonry openings along edges of all plenums at floors and walls, a continuous 2 x 2 x 3/8 inch galvanized angle iron shall be provided. The angle iron shall be bolted to the construction and made airtight to the construction with caulking compound. Sheet metal at these locations shall be bolted to the angle irons.

2.35 PRE-MANUFACTURED DUCTS

A. Runouts above ceiling from primary supply air ducts to VAV terminal boxes may be rigid conduit or pre-manufactured high pressure flex duct or a combination of the two.

B. Runouts above ceiling from the terminal boxes to the ceiling diffusers shall be similar to "Genflex Type IL". Maximum allowance length is 5'-0" in any given duct run. Duct to be factory fabricated with spring steel wire helix and 1" thick glass fiber insulation covered with external vapor barrier and lined with continuous non-perforated inner sleeve.

C. Material shall comply with International Mechanical Code 2018.

2.36 RETANGULAR DUCT LINING

A. The interior surface of all rectangular supply, return, fresh, relief, and exhuast air ducts (except where noted otherwise), shall be lined with 1" thick fiberglass dual density duct liner, having and average "K" factor of .24 BTU at 75 deg. F mean. The linear shall meet standards NFPA No. 90A and No. 90B and shall have the Underwriters' Laboratories, Inc., label.

B. Duct liner shall be applied to the flat sheet with a 100% coverage of duct adhesive. The duct liner shall be cut to assure snug corner joints. The black surface of the liner shall have the air stream. On horizontal runs, tops of ducts over 12" in width and sides over 16" in height shall be additionally secured with welded pins and speed clips on a maximum of 15" centers. On vertical runs, gripnails or welded pins and speed clips shall be spaced on a maximum of 15" centers on all width dimensions over 12". Pins shall start within 2" of all cross joints within the duct section.

C. Welded pins shall be cut virtually flush with the liner surface. Clips should be drawn down flush only and not so as to compress the linear and cause the leading edge to raise. All exposed edges and the leading edge of all cross joints of the liner shall be coated with adhesive.

D. Material shall comply with 2018 International Mechanical Code.

2.37 GAS VENTS (NON-CONDENSING)

A. Vents (flues) for gas-fired equipment shall be of the sizes shown on the drawings. Flues shall be insulated double wall with stainless steel liner. Gas vent approved for continuous flue temperatures up to 1000 deg. F. Units shall be Metalbestos, Metalvent, or DuraVent.

B. Top flues with Metalbestos Type "S-CT" vent cap especially designed for non-backdraft application. Flash and counterflash around flue at point of roof penetration to make watertight. Vertical and horizontal flues shall be double wall stainless steel construction.

C. Flue which serves boiler must be positive pressure type. All flues must be of type approved by local gas company for application.

2.38 INSULATED LOW PRESSURE FLEXIBLE DUCT

A. Low pressure flexible duct shall be fully insulated hight density, factory installed, fiberglass insulation with a minimum R-value of 6.0. The inner core shall be constructed with multiple layers of aluminum foil/polyester laminate and metalized polyester film that encapsulate a steel wire helix. The outer portion of the duct shall be sheathed in multiples of metalized polyester film with fiberglass spiral reinforcing strands to form a continuous vapor barrier. The duct shall be constructed to withstand 6" w.g. positive pressure thru 20" dia. and 3/4" w.g. negative. Duct shall be U.L. listed. Duct to be Casco or approved equal.

2.39 REGISTERS, GRILLES AND DIFFUSERS

A. Supply Air Registers & Linear Diffusers:

1. Furnish and install all supply air registers and linear diffusers shown and specified on the drawings. All units to have opposed blade balancing dampers. Registers and diffusers to have 4-way air deflection. All register cores shall be removable or plaster frames shall be furnished with units. Registers shall be of steel, or anodized aluminum construction. Finish shall be bright white unless otherwise noted. Units shall be Titus, Tuttle & Bailey, Carnes, Metalaire, Nailor, or Price.

B. Linear Diffuser Air Chamber:

1. Supply air chambers for linear diffusers shall be furnished with a round neck air entry collar sized for maximum average air entry velocity of 750 FPM. Each neck shall be 2" long for easy attachement of the flex duct, and will be securely attached to the body of the air chamber securing 0% casing leakage and assuring the cut edges of the fiberglass lining will be protected from the direct air stream. Units shall be constructed from not less than 26 ga. galvinzed steel and shall be lined with 1/2" high density thermal-acoustical insulation. Units shall be manufactured allowing for less than one-half of one percent casing leakage. All surfaces visible through the air bar slot will be painted flat black. Where the ends of the air chamber rest on the diffuser spacer, a gasket shall be installed to insure that there is no air leakage at that point. Chambers shall be as designed to insure uniform air delivery.

C. Return, Exhaust & Transfer Air Registers:

1. Furnish and install all ceiling and sidewall return, exhaust, and transfer air registers shown and specified on the drawings. All units to be painted steel, or aluminum construction (where permitted by fire code) with bright white finish and opposed blade balancing dampers. All core shall be removable or plaster frames shall be furnished with units. Registers located near the floor shall be heavy duty gymnasium type. Registers shall be Titus, Tuttle & Bailey, Metalaire, Nailor, Carnes or Price.

D. Ceiling Diffusers:

1. All ceiling diffusers shall be of the round, square, or rectangular type with louvered face and 1,2,3, or 4 way air pattern as indicatedon the drawings. Units shall be painted steel or aluminum construction (where permitted by fire code) with bright white finish and inner assembly shall be easily removable from outer frame without special tools. Louvers shall be spaced on 1-1/2" centers maximum.

2. All diffusers shall be furnished with round or square opposed blade volume control and air extractor. Diffusers shall be Titus, Tuttle & Bailey, Price, Metalaire, Nailor, or Carnes.

E. General:

1. All registers, grilles, and diffusers located in locker/shower area shall be all aluminum construction.

2. All visible surface through the louvers of grilles and registers shall be painted flat black.

3. Color and finish of all grilles, registers, and diffusers shall match ceiling grid. Coordinate with the Owner's representative.

2.40 LOUVERS

A. At all air system openings in outside wall, install storm louvers.

B. Construct louvers of aluminum with Kynar color coat finish as selected by architect. Provide color samples.

C. Slats shall be inclined at least 45 degrees from the horizontal and overlap a minimum of 1". Slats over 40" long shall have a 2" wide intermediate support. The exterior face of the louver shall be neatly fitted to the building wall, flashed at top, and caulked at sides and bottom. New open area for air passage shall be at least 50% of the nominal size. On the inside face of the louver, install a removable screen, consisting of 1/2" mesh galvanized wire screen in a galvanized channel frame. The louver shall have a sub-frame and shall be removable. See plans for custom louvers required.

D. Caulk around louver frames with clear G.E. silicone sealer after installation. Caulk color shall match color of surrounding material.

E. Louvers shall be drainable type with recessed mounting frames.

F. Louvers shall be Airolite, Air Balance, Air Guide, American Warming, or Dowco.

2.41 EXHAUST FANS

A. Roof-Mounted Type:

1. Furnish and install complete the low profile roof-mounted exhaust fans of the size and capacity shown on the drawings.

2. Roof-mounted fans shall be of the centrifugal type with spun aluminum hood. All parts exposed to weather and all fastenings shall be either aluminum or stainless steel. All fans to be equipped with permanently lubricated two-speed (where specified) ball bearing motors located in separate compartment out of the air stream. Fan shall have adjustable V-belt drive, self-flashing insulated curb, backdraft dampers, birdscreen, disconnect switch, and shall be complete with all necessary fittings and transition pieces for a complete installation. All units shall bear the AMCA certified performance seal.

B. Fans shall be Greenheck, Twin City, Loren Cook or Penn.

C. Propeller Type:

1. Furnish and install complete the propeller ventilation fan shown and specified on the drawings.

2. Fan shall be direct-connection, two-speed, motor-driven type. Wheels shall have steel or aluminum blades with heavy nubs. Mounting rings or plates shall be cast or die-formed to smooth curves where the air enters the wheel. Mounting plates shall prevent distortion and shall be turned up at all edges or braced with steel angles. A wire mesh guard shall be provided on fan. Unit shall bear AMCA Certified Performance Seal.

3. Fan shall be Greenheck, Twin City, Penn or Loren Cook.

D. Ceiling Type:

1. Furnish and install complete the ceiling-mounted exhaust fans shown and specified on the drawings.

2. Fan shall have acoustically insulated housing for quiet operation. Air deliveries shall be as indicated on the drawings and shall be certified by AMCA performance tests.

3. Fan shall have centrifugal wheel direct connected to motor. Ceiling grille shall be all aluminum construction with satin finish. Entire fan, motor, and wheel assembly shall be removable without disturbing the housing. Fan speeds shall not exceed 1100 RPM. Unit shall be complete with back-draft damper.

4. Fan shall be Greenheck, Twin City, Loren Cook, Broan, Breidert or Penn.

E. Utility Type:

1. Utility type exhaust fans shall be backward inclined, non-overloading type. Fan shall be statically and dynamically balanced at factory. Fan shall be furnished complete with ball bearings, vibration isolators, adjustable V-belt drives, greaseproof housings and belt guard. The motor shall be mounted on a heavy bed plate attached to the fan housing with bolts. Motors shall be resilient mounted to absorb the electrical hum and provide quiet operation. Fan shall bear AMCA certified rating seal. Fan shall be mounted on a welded angle frame. Installation shall be vibration free. All fans to have back-draft dampers, grease drains and disconnect switch.

2. Fan shall be Twin City, Loren Cook, Penn or Greenheck.

F. In-Line Clothes Dryer Vent:

1. Furnish and install complete the duct-mounted in-line backward incline fans shown and specified on the drawings.
2. Fans shall be direct drive, with backward curved centrifugal wheels and spun venturi inlets and outlets. Fan bearings shall be rated at 200,000 hours average life. The waterproof fan housing shall be fabricated from metal. Fans shall have variable speed adjustability and external rotor motor.
3. Motor shall be external to fan.
4. Fans shall be furnished with suspension type vibration isolators.
5. Provide factory mounted current sensor.
6. Provide remote status indicating light.
7. Air and sound rating shall be AMCA certified.
8. Fans shall be Tjernlund, Fantech, Penn, Cook or approved equal.

2.42 PRE-FAB DRYER BOX

A. Furnish and install a pre-fabricated dryer vent box similar to 'dryerbox' model DB-480.

2.43 ROOF PENTHOUSES

A. Furnish and install complete the louvered type roof penthouses as shown on plans and specified in the Equipment Schedule. All units shall be of aluminum construction capable of withstanding 100 MPH winds. Unit to be complete with bird-screen, self-flashing roof curb with wood nailer, and all accessories required for complete installation. Hoods shall be hurricane rated construction.

B. Roof penthouses shall be Twin City, Greenheck, Airolite, Ruskin, Penn or Air-Rite.

2.44 ROOF HOODS

A. Furnish and install complete the roof hoods as shown on the plans and specified in the Equipment Schedule. All units shall be of aluminum construction, complete with bird-screen, self-flashing roof curb with wood nailer, and all accessories required for complete installation.

B. Roof hoods shall be Titus, Penn, Greenheck, Loren Cook, Twin City or approved equal.

2.45 AIR FILTER BANKS

A. Furnish and install the filtering bank systems shown and specified on the drawings. Filter banks shall be suitable for the space available. Filter banks shall be constructed and installed so as to prevent the passage of unfiltered air. Felt, rubber, or neoprene gaskets shall be provided between filter frames and unit casing, etc. Steel filter parts shall be protected against corrosion.

B. Filter bank shall consist of 2" thick MERV12(ASHRAE 52-76 test standard) replaceable media type air filters. The supporting front grid of each filter section shall be hinged to facilitate easy replacement of filter media. Filter frames shall be of 18 gauge galvanized steel construction with 11 gauge galvanized steel wire grids to support the media.

C. At time of acceptance of the work, new filter media shall be furnished and installed by the contractor.

D. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each filter bank and store on site as directed by the owner's representative.

E. Air filter banks shall be Cambridge, AFF, or Farr.

2.46 EXTRA AIR FILTERS

A. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each unit using replaceable filters and store on site as directed by Architect.

B. Air filters shall be Cambridge, AFF, or Eco-Air.

2.47 VARIABLE AIR VOLUME RE-HEAT BOXES (VAV)

A. Casings shall be 26 gauge galvanized with flange rectangular discharge duct connection. A one-piece aluminum back-draft damper shall be provided on the fan discharge. The damper shall be factory set and aligned to insure a precise seal. Leakage rate shall not exceed 2 percent of rated capacity at 0.5" static pressure.

B. Automatic damper operators and controllers shall be furnished by the ATC contractor and installed by the VAV box manufacturer. Boxes to be c/w paint tie-in for interface with room occupancy sensors. Provide sheet metal enclosure around damper operator/controller.

C. The VAV box manufacturer shall furnish and install an approved cross flow sensor with a gain factor of not less than three (3).

D. VAV boxes shall be provided with a pressure independent 3-position volume regulator which operates thru a thermostatically reset velocity controller to provide constant air delivery within plus or minus 5 percent of rated flow, and down to 25 percent of the VAV box rated CFM. Factory calibrated field adjustable setpoints shall be provided to set maximum and minimum CFM.

E. The hot water heating coil shall be a single or multiple row unit as specified with plate-type aluminum fins and mechanically bonded to a copper tube carrier pipe.

F. The entire unit shall be serviceable from a single ceiling access door. .

G. Units shall be Price, Krueger, Nailor, or Titus.

2.48 CROSS FLOW PRESSURE SENSORS FOR VAV BOXES

A. Sensors shall be aluminum corrosion resistant of the cross flow type with ported tubes and baffle mounted to a center manifold. The center manifold shall have 1/4" barb fittings for FRPE tubing, and shall provide a differential pressure proportional to the average velocity of air moving through duct.

B. The sensors shall have an amplification factor (gain) of at least three and flow coefficients as follows:

Size	CV
4	209
5	315
6	462
7	612
8	817
10	1250
12	1792
14	2474
16	3235

2.49 HVAC SMOKE DETECTORS

A. All units above 2000 CFM shall be provided with smoke detectors located in the return air intake and supply air discharge as per IMC. Detectos to be provided and wired under Section 16000. ATC contractor to install all detectors.

B. Duct smoke detectors shall not be installed until just prior to final inspection to prevent duct and debris from contaminating detector.

2.50 FUSIBLE FIRE LINK DAMPERS

A. Furnish and install complete the 1 1/2 hr fusible line fire dampers shown on the plans and specified herein. Dampers shall be provided and installed in accordance with NFPA-90A and bear the UL 555 Label of Approval. Fire dampers shall be curtain-type with fusible link located in the air stream. Submit installation drawings.

B. Spring catches shall hold the dampers in a closed position when F.L. is broken. The weight of the mounting frames shall comply with the National Board of Fire Underwriters and approved installation drawings. Sleeves with angles are required at all locations.

C. Provide hinged, gasketed, and latched access panels in duct at each damper. Stencil "Fire Damper" in 1" high red letters on white background at each access panel.

D. Provide ceiling access panels approved by the Owner's representative at each duct access panel when required, for maintenance and inspection of the fusible link.

E. Fusible link dampers shall be Pottorff, Ruskin, Nailor.

2.51 COMBINATION FIRE AND SMOKE DAMPERS

A. Furnish and install at locations shown on plans, combination fire-smoke dampers, Frame shall be minimum 16 guage galvanized steel formed from a continuous channel section. Bearings shall be formed in the frame and shall match the contour of the blade. Blades shall be roll formed single-thickness galvanized steel and shall overlap both frame and adjacent blades a minimum of 3/4". Blade edge and jamb seals shall be low friction type non-degradable steel-to-steel and shall withstand 850 deg. F. with a minimum leakage of 15 cfm/ft. at 1" w.g. Stainless steel flexible metal compression type jamb seals will not be accepted. The torque required to maintain the rating in the closed position shall be 0 in-lbs. Blade linkage shall be interconnected to the damper jackshaft on both ends.

B. Each damper shall be 1-1/2 hour rated per UL standard 555, and shall be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL 555S. The leakage rating under UL 555S shall be no higher than leakage Class II. Dampers shall be tested in HVAC systems to ensure oparation with pressures of at least 4" wg in the closed position, and 2000 fpm in the open position unless noted otherwise. Each damper shall carry a UL label (File No. R11767) and a CSFM label (File No. 3225-368:008).

C. Actuator shall open upon loss of power and shall be rated to an elevated temperature of 250 deg. F. Actuators shall be factory installed and shall be 120 volt electric and shall provide a minimum of 75 in-lbs. of torque at the damper shaft. Damper leakage shall provide for fail closed fire operation independent of the actuator position. Actuator bracket shall be designed to allow for the installation of ductmate without realignment or alterations. Manufacturer shall provide a factory assembled sleeve of 16 gage galvanized steel standard. Damper and actuator assembly shall be factory cycled to ensure proper operation. Dampers shall be installed in accordance with manufacturer's installation instructions. Suitable access shall be provided for inspection and servicing of each damper.

D. Electro-thermal Bi-Metallic Link (resettable) - Each damper assembly shall be equipped with a UL 33 listed electro-thermal bi-metallic resettable 'McCabe Link' that provided for fail closed fire and smoke operation independent of the actuator position, electric sensing stats will not be accepted. Electro-thermal McCabe link shall disengage damper linkage from actuator and mechanically lock damper in a closed position from either a smoke detector signal or when duct temperature exceeds 250 deg. F. (shall not exceed operational limit of actuator). The design shall only allow damper to be reopened when the smoke detector signal is clear and the duct temperature has returned to a safe level, as per NFPA 92A.

E. Damper assembly shall include dual position indicator switch package capable of positively indicating each damper's status as being full-open or full-closed at remote central control panel. Actuator shall be fail open upon loss of power.

F. Dampers shall be Pottorff Model 5010 with PI-50 dual postion indicating switch package.

G. Fire/smoke dampers to be provided and installe into the ductwork by this contractor. Dampers shall be wired by Division 26 0000. installed. Dampers shall be 120/1/60.

2.52 DAMPERS-GENERAL

A. Damper frames shall be of not less than 18 gauge galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.

B. All damper blades shall be of not less than 16 gauge galvanized steel formed for strength and high velocity performance. Blads on all dampers must be of not over 6" in width. Blads shall be secured to 1/2" diameter zinc-plated axles by zic-plated bolts and nuts. All blad bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon-coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blades linkage hardware shall be constructed of corrosion-resistant, zinc-plated steel and brass.

2.53 AUTOMATIC DAMPERS

A. The ATC contractor shall furnish all automatic control dampers. The sheet metal contractor shall install all dampers and transition all ductwork to the dampers.

B. All dampers at rooftops and combustion air damper at roof hood shall be Tampco class 1 dampers. No substitutions.

2.54 PACKAGE ROOFTOP UNITS

A. Furnish and install complete the roof-mounted packaged type Gas/DX cooling unit or cooling only unit, as shown and specified on the plans. Unit to be factory-wired and tested and of capacities as listed. the unit shall be shipped completely assembled, pre-charged, piped, and wired internally, ready for field connections. In addition, manufacturer shall provide field start-up and test for each unit and shall forward a copy of the start-up report to the Architect.

B. The unit shall be complete with integrated economizer capable of simultaneous economizer and compressor operation. Economizer shall include all hardware and controls for cooling with outside air, low leakage dampers not to exceed 3% leakage at 1.0 in. wg pressure differential, capable of introducing up to 100% outside air and equipped with gravity relief air damper. Provide 0-10 VAC control points as required for ATC contractor.

C. Gas-fired heat exchanger shall be constructed of aluminized steel. Power burner shall have electric direct spark ignition, 100% safety shut-off electronic flame sensing controls, pre-purging and combustion air adjustment. All controls shall be listed for operation at low outdoor air temperatures. System shall be equipped with dual limit safety controls, shall be AGA design certified for outdoor installation for natural gas firing, shall be rated and tested according to D.O.E. and F.T.C.

D. Roof curb shall be of steel construction and shall extend 12" minimum above the finished roof surface. The mounting shall made to the bottom perimeter of equipment and distribute the unit weight uniformly to the structure.

E. High- and low-pressure switches shall be factory-installed and wired. These switches shall protect the system against abnormal operating conditions. Low pressure switch shall be automatically reset, high pressure switch shall be manual reset.

F. The unit shall be furnished complete with a field installed starting kit to aid the compressor when the compressor is starting under a condition of low voltage.

G. All components, wiring, and inspection areas shall be completely accessible thru removable panels which have locking door handles.

H. Provide factory hail guards.

I. Provide a factory mounted weather-proof 120-volt GFI outlet.

J. Provide a factory terminal strip for DDC system connection.

K. The compressor section shall carry a 5-year guarantee.

L. Units shall be Carrier, Lennox or approved equal.

2.55 DEDICATED ROOF MOUNTED OUTDOOR AIR SYSTEM (DOAS)

A. SUMMARY

1. This section includes units with integral heating and cooling] for outdoor installation. Integral heat source shall be hot water [Integral cooling source shall be packaged DX. Airflow arrangement shall be Outdoor Air with Recirculation. Each unit shall be constructed in a horizontal configuration.

B. Product Data:

1. For each type or model include the following:

2. Complete fan performance curves for Supply Air.

3. Sound performance data for Supply Air.

4. Motor ratings, electrical characteristics, motor and fan accessories.

5. Performance ratings for DX coils.

6. Dimensioned drawings for each type of installation to include location of attached ductwork and service clearance requirements.

7. Estimated gross weight of each installed unit.

8. Installation, Operation and Maintenance manual (IOM) for each model.

9. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.

10. Standard color

C. Quality assurance:

1. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

2. For the actual fabrication, installations, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

3. Product Options: Drawings must indicate size, profiles, and dimensional requirements of Energy Recovery Unit and are to be based on the specific system indicated. Refer to Division 1 Section “Product Requirements”.

D. Certifications:

1. Blowers shall be AMCA Certified for airflow.

2. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.

E. Coordination

1. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

2. Coordinate location of water system fittings to ensure correct positioning for connection to the water coil and condensate drain pipe.

F. MANUFACTURERS

1. Approved Manufactures: LG, Valent Air or approved Equal.

G. MANUFACTURED UNITS

1. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake hood with 2” aluminum mesh filter assembly, evaporator coil, condensate drain pan, hot water coils, packaged DX system, phase and brownout protection, motorized damper], barometric relief damper, motorized recirculating damper, sensors, curb assembly, service receptacle, filter assembly for intake air, supply air blower assembly and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat and exhaust fan only power if dual point power is selected.

H. CABINET

1. Materials: Formed, 2 inch double wall closed cell foam insulated metal panels and 2” double wall closed cell foam insulated metal door construction, fabricated to permit access to internal components for maintenance.

2. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Internal assemblies: 22 gauge, galvanized (G90) steel except for motor supports which shall be minimum14 gauge galvanized (G90) steel.

3. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

4. Materials: Rigid urethane foam

5. Thickness: 2 inch (50.8 mm)

6. Thermal Resistance: R13

7. Meets UL94HF-1 flame requirements

8. Location and application: Full coverage of entire exterior to include walls, roof of unit, unit base and doors

9. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18gauge galvanized G90 steel or painted galvannealed steel with 2 inch closed cell foam insulation.

10. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fan(s). Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor(s) shall be capable of continuous speed modulation and controlled by a VFD.

11. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of “interlaced” configuration, permitting independent operation of either compressor without conflict with the other compressor

12. Control panel / connections: Rooftop Ventilator units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch

13. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a drain connection at the front (access side) for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.

14. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes.

15. Hot water coil(s) shall be factory installed and meet the design requirements.

16. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan motors shall be, external rotor, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be inverter hermetic scroll-type and shall be equipped with liquid line filter drier, thermostatic expansion valves, manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant.

17. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

18. Global alarm condition (active when there is at least one alarm)

19. Supply Air Proving alarm

20. Dirty Filter alarm

21. Compressor Trip alarm

22. Compressor Locked Out alarm

23. Supply Air Temperature Low Limit alarm

24. Sensor #1 Out of Range (outside air temperature)

25. Sensor #2 Out of Range (supply air temperature)

26. Sensor #3 Out of Range (cold coil leaving air temperature)]

27. Motorized dampers / Outdoor Air Return Air: Damper shall be of insulated low leakage AMCA Class 1A certified construction. Leakage rate shall not exceed 3 CFM/ft2 @ 1 in. wg. and shall be factory installed.

28. AMCA Class 1A motorized recirculating air damper designed to permit 100% maximum recirculation of return air shall be factory installed.

29. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 18”

30. Service receptacle: 120 VAC GFCI service outlet shall be factory-provided and installed [by this contractor in a location designated by the A/E. Unit contains a 120 VAC transformer to provide power to service outlet.

31. Hail guards: Protects the condensing unit from damage due to extreme weather conditions such as hail and flying debris.

32. 24V/120V Smoke detector – Duct smoke detector is shipped loose for field mounting and wiring in the supply or return air duct. The air duct smoke detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The air duct smoke detector housing shall be suitable for mounting indoors. The detector shall operate at air velocities of 100 feet per minute to 4000 feet per minute (0.5 to 20.32 meters/second). The power supply voltage shall be 20-29 VDC, 24 VAC 50-60 Hz, and 120 VAC 50-60 Hz. The detector shall consist of an alarm initiation contact & two DPDT auxiliary contact closures.

I. BLOWER

1. Blower section construction Supply Air: direct drive motor(s) and blower(s) shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.

2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

3. Fan: Direct drive, airfoil plenum fan with painted steel wheels statically and dynamically balanced and AMCA certified for air and sound performance.

4. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

J. MOTORS

1. General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Motors shall be 60 cycle, 3 phase 460 volts.

K. UNIT CONTROLS

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors, or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.

3. RTU supply fan shall be configured for Single Zone VAV

4. Outside Air / Return Air damper control shall be network control.

L. Dirty filter sensor shall be factory-installed.

1. Operating protocol: The DDC shall be factory-programmed for LonWorks, BACnet MSTP, BACnet IP.

2. Variable Frequency Drive (VFD) unit shall have factory installed variable frequency drive for modulation of the supply air blower assembly The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

3. Airflow monitoring required in the Outdoor, Supply.

4. Room thermostat shall be provided as a shipped loose item.

5. Controller shall auto trend 7 days of operating points for trouble shooting purposes.

6. Embedded web page with complete web user interface to allow full remote control and monitoring of unit.

7. Alarm Recording: Controller shall store all alarm events for download.

8. Alarm Operating Snapshot: Controller shall store operating inputs and outputs at time of alarm.

M. FILTERS

1. Unit shall have hood filter shall be of 1 inch aluminum type, supply final air filter shall be of type 2 inch MERV 8 disposable pleated type.

N. EXECUTION

EXAMINATION

1. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

2. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

3. Proceed with installation only after all unsatisfactory conditions have been corrected.

O. INSTALLATION

1. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

P. CONNECTIONS

1. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

2. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.

3. Duct installation and connection requirements are specified in Division 23 of this document.

4. Electrical installation requirements are specified in Division 26 of this document.

Q. FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

R. START-UP SERVICE

1. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

2.56 MAKE-UP AIR UNITS

A. Furnish and install, where shown on plans, make-up air heating, cooling, and ventilating package units. Units shall be approved by American Gas Association for outdoor installation.

B. Blower wheels and all cabinet parts shall be fabricated from hot dipped galvanized steel. Cabinets shall have additional weather resistant alkyd wrinkle enamel coating.

C. Cooling section (where scheduled) shall consist of high efficiency evaporative cooling filter pads with adjustable water distribution trough for leveling. Water supply shall be by means of heavy duty circulating pump with copper distributor tubes. Two-way and three-way control valves shall be supplied with the units.

D. Heating elements shall be stainless steel with burner and controls assembly removable as a unit for service. Burners shall be readily accessible for cleaning and service without disassembly of cabinet or ductwork.

E. Gas controls shall provide modulating gas fire, with momentary high fire start. Electrical controls shall include a wall-mounted control panel with pushbutton actuated switches and individual indicator lights, duct-mounted, two-stage thermostat, and motor contactor, as required. Coordinate with Division 25 contractor.

F. Control panel shall provide choice of heating, ventilating, or cooling function. Unit shall have all internal wiring, including motor and motor controls, factory wired and pre-tested.

G. Each unit shall be shipped complete assembled in a single packaged unit and shall be factory fire tested before shipment.

H. All parts shall carry minimum manufacturer guarantee as follows:

1. 100% hot dipped galvanized cabinet and blower wheel: 5 yrs.
2. Stainless steel heating element: 5 yrs.
3. Water recirculating pump: 2 yrs.

I. Unit shall be furnished with factory curb, intake hood with birdscreen, magnetic starter containing all necessary auxiliary contacts for interlocking the make-up air units with the exhaust fans. Coordinate with Division 25 contractor.

J. Units shall be Trane, Econ-Air, Captive Air, Greenheck, Modine or approved equal.

2.57 ERV UNITS – AIR TO AIR HEAT EXCHANGER

A. Air-to-Air Energy Recovery Ventilators shall be fully assembled at the factory and consist of a fixed-plate cross-flow heat exchanger with no moving parts, an insulated double wall painted 20-gauge steel cabinet, outdoor air hood with bird screen, motorized outside air intake damper, filter assemblies for both intake and exhaust air, enthalpy core, supply air blower assembly, motorized return air damper, exhaust air hood, exhaust air blower assembly and electrical control box with all specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection. Entire unit with the exception of field-installed components shall be assembled and test operated at the factory.

B. Access doors shall be hinged with airtight closed cell foam gaskets. Door pressure taps, with captive plugs, shall be provided for cross-core pressure measurement allowing for accurate airflow measurement.

C. Control center / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections to the [non-fused] disconnect.

D. Motorized Isolation Dampers: Return Air and Outside Air motorized dampers of an AMCA Class I low leakage type shall be factory installed.

E. Blower section construction, Supply Air and Exhaust Air: Blower assemblies consist of a 460V 3 Phase 60 HZ, TEFC motor, and a belt driven forward-curved blower.

F. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

G. Fan control: Motor starter and contactor both airstreams.

H. Dirty filter monitor for both airstreams.

I. Factory-installed microprocessor controller and sensors, Enhanced ERV controls that:

1. Has factory-installed hardware and software to enable the building automation interface via BACnet to monitor, control, and display status and alarms
2. The microprocessor controller shall be capable of operating at temperatures between -20F to 160F
3. Factory-installed microprocessor controller shall come with backlit display that allows menu-driven display for navigation and control of unit
4. The microprocessor controller shall have the ability to communicate with the BMS via Modbus RTU/TCP and BACnet MSTP/IP
5. The microprocessor controller shall have integrated ethernet interface and a web server for displaying unit parameters
6. The microprocessor controller shall have an internal programmable time clock that will allow the user to add up to different occupancy schedules and add holidays
7. The microprocessor control shall be capable of integral diagnostics
8. The microprocessor controller shall at a minimum offer the ability for three modes of determining occupancy: a dry contact, the internal time clock or the BMS
9. A remote user terminal to allow for remote monitoring and adjustment of parameters, allowing ease of control access without going outdoors or into the mechanical room if desired by the user
10. The microprocessor controller shall have at a minimum (10) universal inputs/outputs (AI, DI, AO) and have (6) six relay outputs (DO)
11. The microprocessor controller shall have an integrated fieldbus port
12. The microprocessor controller shall have the capability for I/O expansion
13. The microprocessor controller shall have a micro USB port to load the application program, the unit parameters, saving logs, etc.
14. The microprocessor controller shall have the capability to monitor the unit conditions for alarm conditions. Upon detecting an alarm, the microprocessor controller shall have the capability to record the alarm description, time, date, available temperatures, and unit status for user review. A digital output shall be reserved for remote alarm indication. Alarms to be also communicated via BMS as applicable

J. ERV shall have 2" thick MERV 8 disposable pleated filters located in the outdoor air and exhaust airstreams. All filters shall be accessible from the exterior of the unit.

K. Manufactures: Renewaire, Captiveaire,Ruskin

2.58 UNIT HEATERS (Gas Fired)

A. Furnish and install in the locations shown on the plans the sealed combustion gas-fired unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.

B. Heat exchangers shall be either open or sealed type as shown on drawings, and shall be aluminized steel designed to accommodate thermal stresses without internal damage. Burners shall be AGA approved with 24 volt control circuit and automatic safety pilot.

C. Unit casings shall be of not less than 16 gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

F. Units shall be furnished with 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

G. Provide factory vent and intake kit.

H. Unit heaters shall be Reznor, Hastings, Modine or Lennox.

2.59 UNIT HEATERS (Electric)

A. Furnish and install in the locations shown on the plans the electric unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.

B. Unit casings shall be of not less than 16 gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

C. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

D. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

E. Units shall be furnished with factory disconnect, 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

F. Unit heaters shall be Markel, Chromalox, Raywall, Intertek or approved equal.

2.60 PACKAGED HEAT PUMP UNITS (DUCT FREE SPLIT SYSTEM)

A. Furnish and install complete the air-to-air split system packaged air conditioner shown and specified on the drawings.

B. Evaporator section shall be ceiling mounted type with pre-charged refrigerant system, packaged controls, swing flow outlet air louvers, and packaged, integral, concealed drain pump. Unit shall be complete with filter section, hard wired, wall mounted thermostat, and all controls for automatic operation.

C. Condensing unit section shall be complete with high performance hermetic compressor with high and low pressure safety controls, air cooled condenser with modulating fan controls for operation at outdoor air temperatures as cold as 0 deg. F. Provide hard wired, wall mounted heating/cooling thermostat, auto changeover and all controls for automatic operation.

D. Heating section shall be electric

E. Unit shall be Mitsubishi, Daikin, Lennox, LG, or approved equal

2.61 SAWDUST COLLECTOR: (SC-1)

A. Furnish and install a complete cabinet style, self-contained shaker dust collection system as shown on the plans.

B. Dust-laden air shall enter at the hopper section thru the round inlet connection(s) provided and move upward through the filter elements. The filter arrangement shall be such that the heavier particles can drop out of the airstream before it turns towards the filter media. The clean air shall move through the filter sealing section and into a clean air plenum at the top of the unit. The remaining dust shall be collected on the filter media.

C. Unit must be rated for3,00 ACFM at an external static pressure of not less than 12"" w.g. with a filter area of 422 sq. ft.

D. Overall Construction of the housing shall be 12ga. ASTM hot rolled steel for a pressure rating of ± 20" W.G. The SDC shall be epoxy powder coated inside and outside. Maximum operating temperature shall be 225ºF.

E. Hopper(s) shall be constructed of 12ga. H.R.S. and have a 60º slope with a 14" flanged outlet discharge. Unit configurable to accept (2) 55 gallon metal drums. Support legs shall be designed to Seismic Zone 4, 100 MPH wind loading specifications.

F. The clean air outlet (Discharge) shall be located on the top of the clean air plenum as shown on plans.

G. Filter element assembly shall consist of individual pockets sewn from 9 oz. polyester sateen felt (or other, specify material) and shall include rigid, metal mesh separators. It shall have a total square footage of high efficiency media as shown on the plans.

H. Filter access shall be through the front of the SDC unit via a full height hinged, removable (lift-off) doors with tool free latches. Filter assembly(s) or cassettes shall slide in and out of the cabinet on tracks and be sealed during operation with a camber style locking mechanism. Unit shall have multiple cassettes. No tools shall be required for routine filter replacement.

I. An automatic filter cleaning (shaker) system shall be provided to allow for cleaning of each set of filter elements. The motorized eccentric driven shaker assembly shall be powered by an electric motor (horsepower as shown on the plans) and drive metallic shaker fingers located immediately between each filter pocket. A pre-set timing sequence shall control the cleaning system to allow for a fan coast-down and subsequent operation of the shaker cleaning system.

J. The dust collector shall include a control panel provided in a NEMA 4 enclosure that includes a motor starter and the timer controls for the filter cleaning mechanism. The panel will include blower start/stop and filter cleaning switches and include a suitable step-down transformer and to match the fan and shaker motor voltages.

K. The dust collector fan shall include a blower integrally mounted to the cabinet.

L. Non-overloading centrifugal-type fan with a capacity of 3,200 CFM, +/-20" w.g. static pressure at standard temperature and pressure conditions.

M. The fan housing shall be fabricated with carbon steel and continuously welded to prevent housing pulsation at normal operating conditions.

N. The fan inlet cone shall be mounted internal of the fan housing for ease of assembly and to reduce fan outlet velocity.

O. The fan motor shall be removable without removing the fan assembly to ease service of the fan and motor assembly.

P. Includes an opposed blade outlet damper for air volume control.

Q. The blower is shipped loose, ready for field installation. It can be rotated on 30° increments to meet specific installation orientation requirements.

R. The fan assembly shall be dynamically balanced at the factory before shipment per standard ANSI S2 19-1975, The fans shall be AMCA certified for air performance.

S. The fan housing is finish coated with gray polyurethane paint

T. Magnehelic differential pressure gauge shall be provided to monitor status of filters.

U. Slide gate at hopper outlet.

V. Drum lid latch kit.

W. Sawdust collector shall be United Air Specialties, Camfil/Farr, Torit, or Dust-Hog.

2.62 NO RETURN VALVE: See schedule on drawings.

2.63 ABORT GATE: See schedule on drawings.

2.64 FUME HOOD DUCTS: Fume hood ducts shall be all welded 316 stainless steel with welded joints and seams.

2.65 WST-1 (Welding station table)

A. See schedule on drawings. Manufactured by Car mon or approved equal.

2.66 DISHWASHER EXHAUST DUCT:

A. Furnish and install the dishwasher exhaust ductwork shown on the drawings.

B. Dishwasher exhaust ductwork shall be of the same material and gauges as for standard ductwork. Ductwork shall be soldered air and watertight.

C. Duct access doors shall be similar in construction to Buensode Type S-2, sized as large as possible, but in no case smaller than 18 inches by 12 inches

2.67 FAN COIL UNITS

A. Furnish and install complete the fan coil units of size and capacity indicated on the drawings. The fan coil units shall consists of centrifugal direct driven fans or belt driven fans where stated on drawings, heating hot water and chilled water coils, 4- pipe configuration, condensate drain pans, mixing boxes and controls housed in a heavy duty double wall sound lined cabinet.

B. Fan coil motors shall comply with NEMA UL/CSA standards.

C. Fan coil units shall be double width fan wheels, forward-curved, statically and dynamically balanced, direct or belt driven with the heating, cooling and air capacities listed on the drawing equipment schedule. Units shall be selected for the job site altitude and conditions noted on the drawings. Units shall be of a horizontal configuration with supply, return and outside air connections.

D. Cooling coils shall be a minimum of 6 rows of 3/8" copper distribution piping expanded into aluminum fins. Coils shall be sized for a water/glycol medium of 30%.

E. Heating coils shall be a minimum of 2 rows of 3/8" copper distribution piping expanded into aluminum fins. Coils shall be sized for a water/glycol medium of 30%.

F. Where noted on plans provide fan coil with dx coil and matching condensing unit.

G. Coils shall be factory tested for leakage at a minimum of 500 psig air pressure under water. Coils shall have a working pressure of 400 psig at 200 deg F

H. All hydronic coils shall be equipped with manual air vent

I. Fan coil units shall be furnished without filter sections or filter rails. Filtering of return air will be provided in the classrooms and office spaces by the filter return air grilles.

J. Fan sections shall be horizontal type, direct or belt driven, draw-thru type. Fan motors shall be open, drip-proof, multiple speed, 1750 RPM single phase, suitable for continuous duty. Fan drives shall be variable pitch drive pulley with keyed shaft.

K. Casings shall be double wall sound lined galvanized steel construction, painted with baked on polyurethane based powder coating with textured finish. Casings shall be furnished with hinged access doors for accessing the motor, belt and bearing assemblies.

L. Piping penetrations through the cabinet will be isolated with rubber grommets or bushings. The drain pan will be serviceable and shall be treated with an antimicrobial coating and anti-condensation agent.

M. Fan coil units shall be furnished with a field mounted motor rated toggle disconnect switch to be installed on the fan coil unit in a convenient location.

N. Other Approved Manufacturers Include: Magic-Aire, IEC, or approved equal

2.68 REMOTE CONDENSING UNITS (For Fan Coil).

A. Furnish and install remote air cooled condensing semi hermetic units complete with heavy gauge zinc coated steel casings, compressor motor assemblies, condenser coils, fans, receivers, crankcase heaters, and high and low pressure safety controls, and all operating controls. Provide automatic pump down cycle on the condensing units. Units shall be of the capacity and efficiency listed on the drawing schedules.

B. Casings: Shall be heavy gauge zinc coated steel panels

C. Compressors: Shall be semi hermetic compressor motor assembly. Compressors shall be suspended and mounted on vibration isolators. The motor and compressor sealed in one casing shall be constructed against dirt, air, and moisture.

D. Condenser Coils: Shall be direct expansion type with primary surface constructed to seamless copper tubes, staggered in relation to air flow. The secondary surface shall be constructed of plate type aluminum fins, either mechanically or metalically bonded to the tubes. A coil factory test shall be made at 300 psi under water and completely dehydrated under a vacuum while heated to at least 175 deg. F. Coils shall contain extra liquid subcooling circuits for high capacity cooling.

E. Provide a 5 year refrigeration compressor warranty.

F. Condensing units shall be Carrier, Lennox, Trane, or York.

PART 3 – EXECUTION

A. JOB SITE CONDITIONS

B. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that the work of this section may be installed in accordance with all pertinent codes and regulations in the approved shop drawings.

C. Discrepancies:

1. In the event of descrepancy, immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF EQUIPMENT

A. Install all equipment with adequate space for service and maintenance. Minimum of 24" clearance for all service and control access.

B. VAV boxes, fan coil units, and similar equipment which requires periodic service and maintenance shall be installed in plenum space within 2 ft. of finished ceilings, or within 2ft. of the bottom chord of the structure.

C. All visible surfaces behind grilles and registers shall be painted flat black.

D. Care shall be taken to avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner's representative.

3.3 INSTALLATION OF DUCTS

A. All ducts shsall be installed in compliance with the latest editions of the SMACNA manuals.

B. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All changes, however, must be approved and installed as directed.

C. Pre-manufactured ducts shall be conencted to rigid ducts and equipment with the solid wraps of fabric duct tape and tyton bands drawn tight to form an airtight joint.

D. During the installation, the open ends of all ducts shall be protected by covering with plastic sheet tied in place to prevent debris and dirt from entering.

E. Install this work in cooperation with other trades so that there will be no delay in progress of construction work. It is extremely important that the duct system be clean before connections are made to the VAV boxes.

F. The contractor shall take special care when running exposed ductwork to insure that the final installation is neat in appearance.

G. Spiral ducts running exposed in occupied areas shall be hung with an aircraft cable type hanger.

H. Under no circumstances shall ductwork be supported from the metal roof deck. (See general requirements section 23 0100).

I. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires or straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings or metal roof deck.

J. Hanger and Supports:

1. Hangers for ducts up to 18" in width shall be placed on not more than 8'-0" centers. Ducts 19" and over in width shall be supported on not more than 4'-0" centers. Hangers shall be placed plumb and present a near appearance. Construct hangers from galvanized band iron 1"x1/8" for duct up to 36" wide. Hangers shall extend down the sides of the ducts not less than 9". On ducts less than 9" in depth, hangers shall extend the full depth of the ducts. Attach hangerse to ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs, supporting angles shall be rigidly attached to ducts and to the structure. Angles shall be galvanized and of sufficient size to support the ductwork rigidly. Place supporting angles on at least two sides of the duct. For round ducts, strap hangers shall extend completely around ducts.

2. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires on straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings unless approved by the owner's representative.

K. Ducts at Masonry:

1. Where ducts are shown connecting to masonry openings and along edges of fall plenums at floors and walls, provide a continuous 2" x 2" x 3/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal at these locations shall be bolted to the angle irons.

L. Installation of Food Preparation Area Ducts:

1. Connections from ductwork to hoods shall be performed by this section.

2. Duct systems shall be constructed and installed that grease and/or moisture cannot become pocketed in any portion thereof, and the system shall slope not less than 1/4" per linear foot towards the hood or toward an approved grease reservoir. Where horizontal ducts exceed 75 feet in length, the slope shall be not less than one inch per linear foot. When a centrifugal fan is used, it shall be positioned so that the discharge outlet is in a bottom horizontal position and the air shall be so diverted that there will be no impingement on the roof, other equipment or parts of the structure.

3. Provide access panels in the ductwork from kitchen hood exhaust fans to allow internal inspection and cleaning of exhaust ductwork.

4. Locate not more than 12 feet 0 inches on centers, and at all elbows. Coordinate location of access panels with available maintenance access space.

3.4 STORAGE OF DUCTS

A. Ductwork shall be stored in a protected area to prevent physical damage to the duct liner, and to insure that the duct liner is not exposed to excessive heat or moisture which would deteriorate the air side surface.

B. Ductwork which has been improperly stored and/or sustained physical damage will be rejected, and shall be removed from the job site as directed by the Owner's representative.

3.5 CLEANING DUCTS

A. Before ducts are insulated and before the ceiling is installed and final connections made to the terminal boxes, the fans shall be operated at full capacity to blow out any dirt and debris from the ducts. If it is not practical to use the main supply blower for this cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned and initially pressure tested, the final connection shall be made to the terminal boxes.

3.6 FIRE & RADIATION DAMPER OPERATION

A. The sheet metal contractor shall operate each fire and ceiling radiation damper and demonstrate that each damper will operate without binding and is securely fastend in partition.

3.7 TESTING OF DUCTS

A. Supply, return, and exhuast ducts, plenums, and casings operating at duct pressures from +2" to -2" shall be tested and made substantially airtight at static pressure indicated for the system before covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean a leakage rate less than 5% of rated airflow.

B. Supply air ducts operating at pressures above +2" shall be tested and made substantially airtight. Leakage shall be less than 1% of the rated air flow.

C. Ducts including all flexible runouts shall be tested in accordance with SMACNA Duct Construction Standards.

D. After the vertical duct risers or branch ducts have all been testedd and tied into the mains, and after the central station air handling apparatus has been installed, the mains shall be tested in accordance with SMACNA Duct Construction Standards.

E. Kitchen hood grease ducts shall be tested per 2018 IMC 506.3.2.5

3.8 KITCHEN HOOD PERFORMANCE TEST

A. A capture containment test shall be performed for the kitchen hood exhaust system. Test shall be conducted upon completion and before final approval of the insulation of the ventilation system - test shall be in compliance with 2018 IMC 507.6.1.

DIVISION 24 - MECHANICAL COMMISSIONING

24 00 00 INDEPENDENT MECHANICAL COMMISSIONING

SECTION 24 0000
INDEPENDENT MECHANICAL COMMISSIONING

PART 1 – GENERAL

1.01 GENERAL CONDITIONS

A. The role of the Commissioning Agent will be to coordinate and administer the commissioning process, asdefined herein. The project incorporates commissioning process for mechanical systems commissioning. The commissioning agent shall be independent of the mechanical contractor and shall not be sub-contracted to the mechanical contractor or any of the mechanical contractor's sub-contractors.

B. The General Contractor and his mechanical subcontractors (and associated trade subcontractors) shall be the prime contractor responsible for the installation and placing in service of all mechanical systems in the building. The Owner's Project Manager and the General Contractor shall assist the Commissioning Agent in implementation of the commissioning plan and in maintaining the schedule of commissioning events. The commissioning process will not be a substitutefor any work by the General Contractor, or any Sub-Contractor of the General Contractor, to install orplace in service any equipment or system in the building.

C. The Mechanical Contractor, including all associated subcontractors and equipment manufacturers, shall be fully responsible for installation, start-up, testing,adjusting, and balancing, and verification and performance testing of all equipment and systems as required by the project specifications. The Mechanical Contractor, including all associated subcontractors and equipment manufacturers, shall be an active participant in the commissioning process as specified herein, as required, and as directed by the Owner's Project Manager, the Commissioning Agent, and the General Contractor.

D. The commissioning process shall be a team effort to ensure that all mechanical equipment and systems have been completely and properly installed and function together correctly to meet the design intent. The commissioning process shall also document system performance parameters for fine tuning of control sequences and operational procedures. The commissioning process shall coordinate system documentation and installation; equipment start-up; building automation system calibration; testing, adjusting, and balancing; and verification and performance testing.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditionsand other Division 01 specification sections, apply to work of this Section.

1.03 COMMISSIONING TEAM

A. A representative of each of the following parties shall be designated as a member of the CommissioningTeam:
   1. Owner or Owner's Representative.
   2. Commissioning Agent (CxA).
   3. Owner's Project Manager.
   4. General Contractor.
   5. Mechanical Contractor.
   6. Building Automation System (BAS) Subcontractor.
   7. Testing, Adjusting and Balancing (TAB) Subcontractor.
   8. Electrical Contractor (including communications and security system contractors)
   9. Other subcontractors and equipment manufacturers as required.

B. Each representative must attend scheduled meetings, in accordance with the Commissioning Agent'sschedule.

1.04 SCOPE OF WORK

A. The work included in the commissioning process shall involve a complete and thorough evaluation of theoperation and performance of all equipment and systems installed under this project. Equipment and systems that shall be evaluated include, but are not limited to, the HVAC systems and the Plumbing systems.

B. Documentation required from the Mechanical Contractors,as part of the commissioning process shall include as appropriate the HVAC Systems and Plumbing systems

C. Documentation required from the Mechanical and Plumbing Contractors as part of the commissioning process shall include as appropriate and applicable:

1. Equipment submittals and shop drawings for CxA review.
2. Progress and status reports, including deficiencies noted.
3. Manufacturers' suggested pre-functional checklists for CxA's use in developing pre-functionalprocedures.
4. Start-up and testing documentation associated with systems being commissioned including but notlimited to the following: duct leakage, pipe pressure, electrical testing, flushing / cleaning, etc.
5. Performance (sign-off) of pre-functional checklists documentation. Including completed manufacturer start-up reports.
6. Training agenda and material for CxA's review.
7. Operation and maintenance (O&M) manuals.

D. Pre-functional Checklists, Tests, and Startup:

1. Pre-functional checklists (PC) are important to ensure that the equipment and systems are hookedup and operational and that functional performance testing may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout by the Contractor. No sampling strategies are used by the contractor. In general, the pre- functional testing for a given system must be successfully completed prior to formal functional performance testing or equipment or subsystems of the given system.
2. Pre-functional checklists are primarily static inspections and procedures to prepare the equipmentor system for initial operation (e.g., oil levels OK, fan belt tension, labels affixed, gages in place, sensor calibration, etc.). However, some pre-functional checklist items entail simple testing of thefunction of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word “pre-functional” refers to before functional testing. Pre- functional checklists augment and may be combined with the manufacturer's start-up checklist.
3. Contractors typically already perform some, if not many, of the pre-functional checklist items thecommissioning authority will recommend. This project requires that the procedures be documented in writing by the installing technician where detailed in the project MEP specifications. The CxA does not witness most of the pre-functional check listing, except for testing of larger or more critical pieces of equipment and some spot-checking. It is noted that thechecklists generated by the CxA do not take the place of manufacturer or contractor required checklists. The CxA, with assistance as required from the installing contractor, will complete checklists that are generated by the CxA.

E. Commissioning Tests: Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents and the design intent. All functional tests shall be witnessed by The Commissioning Agent. The following testing is required as partof the commissioning process:

1. Verification Functional Tests:
    a. Verification tests shall be comprised of a full range of checks and tests to determine that allcomponents, equipment, systems, and interfaces between systems operate in accordance with contract documents and the design intent. This shall include all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
2. Functional Performance Tests:
    a. Functional performance tests shall determine that the commissioned systems are operatingin accordance with the Contract Documents and the design intent.

1.05 ROLES AND RESPONSIBILITIES

A. All Commissioning Team members shall be involved in the commissioning process. Following is a description of the responsibilities of each party:
    1. Owner or Owner's Representative:
        a. Assign maintenance personnel and schedule them to participate in meetings, trainingsessions, and inspections.
    2. Commissioning Agent:
        a. Develop the commissioning plan.
        b. Review submittals for major equipment being commissioned.
        c. Coordinate and administer the commissioning effort, through organization of all meetings,commissioning tests, demonstrations, and assisting with training events, described in the Contract Documents and in the commissioning plan.
        d. Verify and spot check that pre-functional checklists and initial start-up has been performedand documented by the responsible mechanical, electrical contractors and their subcontractors.
        e. Observe equipment and system start-up and testing. Ensure the results are documented (including a summary of deficiencies), and manufacturer / contractor start-up forms areincorporated in the O&M manuals.
        f. Attend the training sessions.
        g. Prepare detailed verification and functional performance testing procedure data sheets.
        h. Conduct verification testing.
        i. Conduct functional performance testing.
        j. Re-test if performance deficiencies are found, corrected, and additional testing is requested.Only one retest will be performed. If the issue still remains after the re-test the additional cost to re-test will be incurred by the responsible contractor. See section 3.03 below for further details.
        k. Review O&M manuals.
        l. Perform functional performance testing to accommodate seasonal tests and incorporate theresults into the commissioning report.
        m. Prepare the final commissioning report.
        n. Assemble the final project documentation which shall include the Commissioning report.

o. Perform 10 month warranty walkthrough

3. Project Manager:
    a. Assist the Commissioning Agent in establishing the commissioning plan and in maintaining the schedule of commissioning events.
    b. Attend all commissioning coordination meetings scheduled by the Commissioning Agent.
    c. Keep the Commissioning Agent apprised of the schedule of work so that the Commissioning Agent can update the commissioning plan as the project progresses.
    d. Direct General, and Mechanical, as required to satisfactorily complete the commissioning process.
4. General Contractor:
    a. Attend all commissioning coordination meetings scheduled by the Commissioning Agent.
    b. Direct the Mechanical Contractor, as required to satisfactorily complete the commissioning process.
    c. Oversee the installation and placing in service of all building equipment and systems.
    d. Oversee the performance and documentation of the pre-functional checklists by mechanical contractor, and their subcontractors prior to the beginning of commissioning verification and functional testingof the equipment.
    e. Respond to issues noted in the Commissioning Agent field and summary reports.
5. Mechanical Contractor:
    a. Include cost to complete commissioning requirements for mechanical systems in the contract price.
    b. Attend commissioning coordination meetings at the discretion of the Commissioning Agent.
    c. Arrange for various subcontractors and equipment manufacturers to attend commissioningcoordination meetings scheduled by the Commissioning Agent, as indicated herein and as required.
    d. Furnish or arrange for all labor, materials, and special tools and equipment required forexecution of the commissioning process.
    e. Include requirements for submittal data, O&M data, training, and commissioning in eachpurchase order or sub-contract written.
    f. Ensure cooperation and participation of specialty subcontractors such as sheet-metal,piping, refrigeration, water treatment, BAS/ATC, TAB, etc.
    g. Ensure participation of major equipment manufacturers in appropriate training and testingactivities.
    h. Coordinate and provide pre-functional checklist documentation per this section and the Commissioning Plan as developed by the Commissioning Agent.
    i. Assist the Commissioning Agent in performing all verification and functional performancetests.
    j. Respond to issues noted in the Commissioning Agent field and summary reports.

k. Prepare a preliminary schedule for mechanical system orientation and inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, etc., and task completion for use by the Commissioning Agent. Updateschedule as appropriate throughout the construction period.

l. Gather O&M data on all equipment, and assemble in binders as required by the specifications. Submit to Commissioning Agent prior to the completion of construction. O&M manuals are to be issued to the project team within 60 days of the submittals being approved.

m. Notify the Project Manager a minimum of 10 working days prior to start-up of each specific piece of equipment and system start-up, so that observation and testing can occur.

n. Participate in, and schedule subcontractors and manufacturers to participate in all trainingsessions as set up by the Commissioning Agent.

6. Testing, Adjusting, and Balancing (TAB) Subcontractor:

   a. Include cost for commissioning requirements in the contract price.

   b. Attend initial commissioning coordination meeting scheduled by the Commissioning Agent, and other commissioning coordination meetings, as requested.

   c. Submit the TAB procedures to the Commissioning Agent for review and acceptance.

   d. Attend a TAB review meeting scheduled by the Commissioning Agent. Be prepared to discuss the procedures that shall be followed in testing, adjusting and balancing the HVACsystem.

   e. At the completion of the TAB work, and submittal of final TAB report, notify the Mechanical Contractor and Project Manager.

   f. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the Commissioning Agent forverification or diagnostic purposes.

7. Building Automation System (BAS) Subcontractor:

   a. Include cost for commissioning requirements in the contract price.

   b. Attend initial Commissioning coordination meeting scheduled by the Commissioning Agent, and other commissioning coordination meetings as requested.

   c. Review design for controllability with respect to selected manufacturers equipment;

      1) Verify proper hardware specification exists for functional performance required byspecification and sequence of operation.

      2) Verify proper safeties and interlocks are included in design.

      3) Verify proper sizing of control valves and actuators based on design pressure drops.Verify control valve ability to control coil properly.

      4) Verify proper sizing of control dampers.

      5) Verify proper selection of sensor ranges.

      6) Clarify all questions of operation.

   d. Provide the following information to the Commissioning Agent:

      1) Narrative description of each control sequence for each piece of equipment controlled.

2) Diagrams showing all control points, sensor locations, point names, actuators, controllers, etc.

3) A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each standalone control unit.

4) Hardware operation and maintenance manuals.

5) Integrate installation and programming schedule with construction and commissioning schedules.

6) Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system.

7) Perform pre-functional checklist of controls on equipment requiring control pre-functional checks.

8) Demonstrate system performance to Commissioning Agent including all modes of system operation (e.g., normal occupied, normal unoccupied, abnormal, emergency).

9) Provide control system technician and instrumentation for use during all system verification and functional performance testing.

10) Provide system modifications as required.

11) Provide support and coordination with TAB Trade on all interfaces between the ATC and TAB scopes of work. Provide all devices, such as portable operator's terminals, for TAB use in completing TAB procedures.

12) Additional trend logs may be required to facilitate the commissioning process.

8. Equipment Suppliers and Miscellaneous Contractors:

   a. Include cost for commissioning requirements in the contract price.

   b. Attend initial Commissioning coordination meeting scheduled by the Commissioning Agent, and commissioning coordination meetings as requested.

   c. Provide appropriate O&M manual section(s).

   d. Participate in appropriate training sessions as scheduled by the Commissioning Agent.

   e. Demonstrate performance of equipment as applicable.

1.06 DOCUMENTATION

A. The Commissioning Agent shall oversee and maintain the development of commissioning documentation. The commissioning documentation shall be kept in three ring binders, and organized by system and sub-system where practical. All pages shall be numbered, and a table of contents page(s) shallbe provided. The Commissioning documentation shall include, but not be limited to, the following:

   1. Applicable drawings and specifications (provided by the design team).

   2. Approved test and balance report for the building being commissioned.

   3. All verification and functional performance test checklists/results, organized by system and sub-system.

PART 2 – PRODUCTS

2.01 SPECIAL TOOLS AND/OR PROPRIETARY TEST EQUIPMENT

A. Special tools, proprietary test equipment, and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed.

PART 3 – EXECUTION

3.01 GENERAL

A. A pre-construction meeting of all Commissioning team members shall be held at a time and place designated by the Owner's Project Manager. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

1. Two additional "kick-off" meetings will also be held prior to the commissioning functional testing.The second meeting will "kick-off" the pre-functional checklists, initial start-up, and scheduling. The third "kick-off" meeting will be held to discuss and schedule the functional testing, acceptance, training, and turnover.

2. Additional meetings will be scheduled by the Commissioning Agent as needed to facilitate thecommissioning process.

B. The Mechanical Contractor, and other applicable sub-contractors shall complete all phases of work so the systemscan be started, tested, balanced, and commissioning procedures undertaken. This includes the completeinstallation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.

C. Commissioning procedures may begin prior to completion of a system and/or sub-systems, and shall becoordinated with the Commissioning Agent. Start of commissioning procedures before system completion does not relieve the Mechanical Contractor and other applicable sub-contractors, from completing those systems as per the contract requirements.

3.02 PARTICIPATION IN ACCEPTANCE PROCEDURES

A. The Mechanical Contractor and applicable sub-contractors, shall provide skilled technicians to support startup, testing, and debugging all systems within their respective specification sections and divisions. These same technicians shall be made available as necessary to assistthe Commissioning Agent in executing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Agent and coordinated by the Mechanical Contractor.

B. System performance problems and discrepancies may require additional technician time, CommissioningAgent time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

3.03 DEFICIENCY RESOLUTION

A. In some systems, maladjustments, misapplied equipment, and deficient performance under varying loadswill result in additional work being required to re-commission the systems. This work will be completed under the direction of the Project Manager, with input from the Commissioning Agent and Design Engineer. All Commissioning Team members will have input and the opportunity to discuss the work andresolve problems.

B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Project Manager indicating the nature of the problem and expected steps to be taken.

C. The cost for the contractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.

D. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no "charge" to the CM/GC for their time. However, the CxA's and owner's time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible contractor or subcontractor. Before retesting occurs, the CM/GC will inspect the deficiency and respond to the CxA that the issue has been addressed.

E. The time for the CxA and owner to direct any retesting required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC, who may choose to recover costs from the party responsible for misinformation or deficiency.

F. The contractor shall respond in writing to the CxA and owner at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

G. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the CM/GC, contractors or subcontractors.

3.04 SEASONAL COMMISSIONING

A. Seasonal commissioning pertains to testing close to full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning shall be done as soon as contract work is completed, regardless of season.

B. Heating equipment shall be tested during heating season. Cooling equipment shall be tested during cooling season with a normal level of building occupancy. Each contractor and supplier shall be responsible to participate in the initial and the alternate peak season tests of the systems as required in order to demonstrate performance.

3.05 OPERATING AND MAINTENANCE (O&M) TRAINING

A. Training: Comprehensive training of Owner's maintenance personnel shall be performed by the Mechanical Contractor, with assistance and input from the Commissioning Agent, and where appropriate, by subcontractors, and equipment manufacturers.

1. Training shall be on-site and/or at other mutually agreed to places. Training shall begin prior to turnover of building to the Owner, and shall continue for a reasonable period of time after turnover.

2. It is anticipated that training will be provided in multiple sessions as noted in the project specifications. The quantity of sessions will be clarified in various equipment/systems project specifications.

3. The training shall include hands-on O & M instruction on the installed equipment and systems to be provided by the various MEP contractors or their representatives. The training shall emphasizeoperating instructions, and preventive maintenance as described in the operation and maintenance (O&M) manuals. The O & M manuals can be reviewed during the training sessions with the MEP representative in greater detail as desired by the Owner. The training period shall include an onsite inspection, explanation, and review of the MEP systems encompassed by the commissioning process and is to be delivered by the MEP contractors.
4. Training requirements are partially specified in this specification section, and further specified inother specification sections.

B. The Mechanical Contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manneron a schedule agreeable to the Commissioning Agent and the Owner.

C. The Mechanical Contractor shall provide,well before substantial completion, a proposed agenda and schedule for training for approval by the Commissioning Agent and the Owner.

D. Training shall include:
1. Use of the printed installation, operation, and maintenance instruction material included in theO&M Manuals.
2. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include review of start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
3. Discuss relevant health and safety issues and concerns.
4. Discuss warranties and guarantees.
5. Cover common troubleshooting problems and solutions.
6. Explain information included in the O&M manuals and the location of all plans and manuals inthe facility.
7. Discuss any peculiarities of equipment installation or operation.
8. Any classroom sessions provided may include the use of overhead projections, slides, video andaudio taped material as required by specifications.

3.06 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.04, Scope ofWork. Some systems that are not comprised so much of actual dynamic machinery may have very simplified Pre-functional Checklists and startup.
1. General:
a. Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in depth systemcheckout) may proceed without unnecessary delays. Each piece of equipment receives fullpre-functional checkout. No sampling strategies are used. The pre- functional testing for a given system must be successfully completed prior to formal functional performancetesting of equipment or subsystems of the given system.

2. Start-up and Initial Checkout Plan:
    a. The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start up plans as required for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each ofthe manufacturer recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and the commissioning plan.
    b. Checklists generated by the CxA are provided to the Contractor for informational purposes.
    c. The Subcontractor responsible for the purchase of the equipment develops the full start upplan by combining (or adding to) the CxA' s checklists with the manufacturer's detailed start up and checkout procedures from the O&M manual and the normally used field checkout sheets.
        1) The full start up plan could consist of something as simple as:
            a) The CxA's pre-functional checklists.
            b) The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
            c) The manufacturer's normally used field checkout sheets.
    d. The subcontractor submits the full startup plan to the CxA for review and approval asrequired in the project specifications.
    e. The CxA reviews and approves the procedures and the format for documenting them,noting any procedures that need to be added.
3. The CxA collects all submitted items and assembles a complete report.

3.07 DOCUMENTATION, FUNCTIONAL PERFORMANCE TESTING

A. Documentation: The CxA shall witness and document the results of all functional performance tests usingthe specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Project Manager and to the Subs for informational purposes. The CxA will include the filled out forms in the final commissioning report.

B. Non-Conformance:
    1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Project Manager on astandard noncompliance form.
    2. Corrections of minor deficiencies identified may be made during the tests at the discretion of theCxA. In such cases the deficiency and resolution will be documented on the procedure form.
    3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
    4. As tests progress and a deficiency is identified, the CxA will discuss the issue with the executingcontractor.

a. When there is no dispute on the deficiency and the Subcontractor accepts responsibility to correct it:

   1) The CxA documents the deficiency and the Subcontractor's response and intentions and they go on to another test or sequence. Subsequently, the Subcontractor corrects the deficiency, notifies the Project Manager and Commissioning Agent that the equipment is ready to be retested. The Commissioning Agent then retests the deficient system/component and documents the results.

   2) This process is repeated until the discrepancy is appropriately resolved. See section 3.03 above with regards to re-testing more than one time and potential cost overruns.

b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

   1) The deficiency shall be documented with the Subcontractor's response and a copy given to theProject Manager.

   2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E.Final acceptance authority is with the Owner.

   3) The CxA shall document the resolution process.

   4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and notifies the Project Manager and the Commissioning Agent. The Commissioning Agent reschedules the test and the test is repeated untilsatisfactory performance is achieved.

5. The Contractor shall respond in writing to the Commissioning Agent and Project Manager at leastas often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements, proposals for their resolution, and current status of completion.

6. The Commissioning Agent retains the original discrepancy documentation until the end of the project.

DIVISION 25 - INTEGRATED AUTOMATION

25 10 00 BUILDING AUTOMATION SYSTEM

SECTION 25 1000
AUTOMATIC TEMEPRATURE CONTROLS (ATC)

PART 1 – GENERAL

1.1 SCOPE

A. This project includes the replacement of the existing ATC system with one ATC system for the new and existing building(s). A completely new ATC system shall be fully operational upon completion of all phases of construction.

B. The intent is to keep the existing controls in the classrooms until the mechanical equipment is replaced in a future phase. Any existing control modifications (removal of controllers, alarms, communication issues, etc.) shall be by DCSD. Existing controls to include but not limited to (see mechanical drawings for clarification of existing conditions):

1. Water Source Heat Pumps
2. Air Handling Units
3. Dedicated Outside Air Units
4. Make Up Air Units
5. Roof Top Units
6. Room Safety Controls (Gas, Exhaust Fans, Etc.)

C. Controls for the existing loop water system shall be replaced during the initial phase of construction. A new hot and chilled water system shall replace the ground loop system and new controls shall be provided. These new systems will provide hot and chilled water to the water source heat pump loop.

1.2 PRODUCTS

A. Products Furnished but Not Installed under This Section

1. Sensors and Transmitters

    a. Flow meters
    b. Flow switches
    c. Pressure Taps
    d. Refrigerant pressure and temp sensor wells & sockets
    e. Hydronic temp sensor wells and sockets

2. Control Valves

3. Control Dampers

1.3 Products Installed but Not Furnished under This Section

A. Make Up Air Unit Control Panels
B. Boiler Controls
C. Fume Hood Switches
D. Split System Controls and Interlock Wiring
E. Roof Top Unit Controls
F. Infrared Heater Controls
G. Snow Melt System Controls

1.4 Products Not Furnished or Installed under but Integrated with the Work of This Section

A. Section - General

1. Coordination Meeting – This contractor will coordinate with other trades and vendors for integration requirements for the following systems

    a. Variable frequency drives
    b. Boiler controls (Verify existing conditions and integration options)
    c. Chiller controls (Verify existing conditions and integration options)
    d. Packaged AHU/RTU cooler controls –IF PACKAGED ROOF TOP UNIT DO NOT COME WITH BACNET MS/TP INTERFACE CARDS, THIS CONTRACTOR WILL PROVIDE A CONTROLLER TO MONITOR SPACE TEMP, DISCHARGE AIR TEMP, FAN STAUS.

1.5 Related Sections

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

1.6 Description

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.
The existing architecture provides the operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in 23 9000 – “Sequence of Operations for HVAC Controls” shall be BACnet objects.

D. **The existing school control system is TAC and shall be replaced under this contract. Replace all existing controllers, temperature, pressure, humidity, flow devices, CTs, and relays with new controls to match the expansion. Coordinate with DCSD for requirements.**

1.7 Approved Control system Manufacturers

A. BASE BID - The following are approved control system suppliers, manufacturers, and product lines:

Supplier	Manufacturer	Product Line
Control Solutions Group	Automated Logic Corporation	WebCTRL

The above list does not indicate order of preference. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

1.8 Quality Assurance

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.9 Codes and Standards

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:

B. National Electric Code (NEC)

C. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

1.10 Submittals

A. Product Data and Shop Drawings: The contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and three 11" x 17" prints of each drawing. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. Riser diagrams showing control network layout, communication protocol, and wire types.
2. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
3. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
4. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
5. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.

B. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents of the documents shall be submitted for approval prior to final completion and shall include:

1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2015 (or newer) compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11" x 17" prints.

2. Provide laminated 11" x 17" as-built drawings (flow diagram, sequence of operation, panel drawing, etc.) in each control cabinet for the associated equipment. Drawings to be located inside the control enclosure or chained to the conduits feeding the cabinet.
3. Testing and Commissioning Reports and Checklists. Completed vendor standard versions of reports, checklists, and trend.
4. Operation and Maintenance (O&M) Manual.
5. As-built versions of submittal product data.

1.11 Warranty

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 24 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period.

1.12 Ownership of Proprietary Material

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics
2. Record drawings
3. Database
4. Application programming code
5. Documentation

PART 2 – MATERIALS

2.1 Materials

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

PART 3 – COMMUNICATION

3.1 Communication

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

B. Install new wiring and network devices as required to provide a complete and workable control network.

C. Use existing Ethernet backbone for network segments marked "existing" on project drawings.

3.2 Operator Interface

A. The DCSD server is existing and shall be reused.

B. Coordinate with DCSD IT Department for any additional requirements.

C. System Software.

1. Operating System. The Server software (WebCTRL) is existing and shall be reused.

2. This contractor shall upgrade all BAS software required to make any changes at any level of the system to the most current version available at the time of the warranty letter date.

    a. Verify all existing schools, equipment, integrations, graphics, etc. are fully functional on the new upgraded software.

    b. Graphics for existing ALC schools will remain AS-IS.

D. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

E. System Applications. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Manual Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection. Operators shall be able to configure the system.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. Help videos shall be provided within the system to assist the operator with standard operating procedures, trends, alarm, scheduled, etc.

5. Security. Each operator shall be required to log on to the system with user name and password in order to view, edit, add, or delete data.

a. Operator Access. The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System Administrators shall also be able to vary and deny each operator's privileges based on the geographic location, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.
b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time shall be user adjustable.
c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 9000 (Sequences of Operation). Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms.

9. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.

11. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 23 9000 (Sequences of Operation). Trends shall be BACnet trend objects.

12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:

    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

1) Alarm History.
2) Trend Data. Operator shall be able to select trends to be logged.
3) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Documentation Links. Operator shall be able to access Operation & Maintenance documentation from the graphical page associated with the equipment document.

F. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.

3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.

b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step’s time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.

1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

3.3 Controller Software

A. Furnish the following applications for building and energy management. All software application shall reside and operate in the system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:

1. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.

C. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

D. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

E. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.

F. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.

G. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

H. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.

I. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

J. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

K. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.

L. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Section 23 9000 (Sequence of Operations).

3.4 Controllers

A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

3.5 Auxiliary Control Devices

A. Motorized Control Dampers, unless otherwise specified elsewhere, shall be as follow.

1. Type. Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.

    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
    b. Other modulating dampers shall be opposed-blade.
    c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (⅛ in.) extruded aluminum with reinforced corner bracing.

3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).

4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.

5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 $L/s \cdot m^2$ (10 cfm per ft^2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).

6. Sections. Individual damper sections shall not exceed 125 cm × 150 cm (48 in. × 60 in.). Each section shall have at least one damper actuator.

7. Modulating dampers shall provide a linear flow characteristic where possible.

8. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators. – Belimo

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
3. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–s20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
4. Wiring. 24 Vac, 120 Vac, and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb.) torque capacity shall have a manual crank.

C. Control Valves.

1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.

2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

    a. Water Valves:

        1) Two-way: 150% of total system (pump) head.
        2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

    b. Steam Valves: 150% of operating (inlet) pressure.

3. Water Valves.

    a. Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.

    b. Sizing Criteria:

        1) Two-position service: Line size.
        2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
        3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa (5 psi) maximum.
        4) Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball.
        5) Valves 2½ in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.

c. Water valves shall fail normally open or closed, as scheduled on plans, or as follows:

1) Water zone valves—normally open preferred.
2) Heating coils in air handlers—normally open.
3) Chilled water control valves—normally closed.
4) Other applications—as scheduled or as required by sequences of operation.

D. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C–30°C (55°F–85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft.) long. Element shall sense temperature in each 30 cm (1 ft.) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be AUTO reset only.

E. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft.) in length per 1 m^2 (10 ft^2) of duct cross-section.
3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
4. Space Sensors. In private areas and classrooms, space sensors shall have setpoint adjustment and override switch with communication port for test and balance and communication trunk access/trouble shooting. COORDIANTE WITH ENGINEER FOR ALL SENSOR REQUIREMENTS BEFORE SENORS ARE INSTALLED.
5. Space Sensors. In public areas, space sensors shall be blank stainless steel plate. COORDINATE WITH ENGINEER FOR ALL SENOR REQUIREMENTS BEFORE SENSORS ARE INSTALLED.
6. Differential Sensors. Provide matched sensors for differential temperature measurement.

F. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20%–80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°C–75°C (-40°F–170°F).
4. Humidity sensors shall not drift more than 1% of full scale annually.

G. Flow Switches. Flow-proving switches shall be paddle (water service only) or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Paddle switches shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

H. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
3. Accessible relays for all equipment will have local override switches within the relay so equipment can be locally enables/disabled. If the relay is located in an inaccessible location, standard relays can be installed. Safeties and sequence requirements will function in the manner required regardless of manual override command. (i.e. - Low limits, combustion air dampers, fire alarm shutdowns, etc. will not allow the piece of equipment to be manually overridden even if the relay is locally enabled) Funtinal Devices RIBU1S or similar.

I. Override Timers.

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown. Provide a clear label for all override timers switches indicating what equipment is being controlled.

J. Override Switches with local indication.

1. Unless implemented in control software, override switch shall be single-gang vertical wall switch with pilot light, with contact rating and configuration required by application. Provide a clear label for all override switches indicating what equipment is being controlled.

K. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

L. Current Transformers.

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

M. Voltage Transmitters.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

N. Voltage Transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

O. Emergency Stop Switches.

1. NEMA 4X/12 Nonmetal enclosure, surface mount.
2. Highly visible yellow/black background. Label to read “Emergency HVAC Shut-down”
3. Button Style – Red maintained 40 mm mushroom (push-pull).
4. Supply voltage – 24 VAC, 120 VAC.

P. Hydronic Flowmeters

1. Insertion-Type Turbine Meter

    a. Dual counter-rotating axial turbine elements, each with its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Single turbine for piping 2 inches and smaller. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.

    b. Insertion type complete with ‘hot-tap’ isolation valves to enable sensor removal without water supply system shutdown.

    c. Sensing method shall be impedance sensing (nonmagnetic and non-photoelectric)

    d. Volumetric accuracy

        1) ± 0.5% of reading at calibrated velocity
        2) ± 1% of reading from 3 to 30 ft./s (10:1 range)
        3) ± 2% of reading from 0.4 to 20 ft./s (50:1 range)

    e. Each sensor shall be individually calibrated and tagged accordingly against the manufacturer’s primary standards which must be accurate to within 0.1% of flow rate and traceable to the National Institute of Standards and Technology (NIST).

    f. Maximum operating pressure of 400 psi and maximum operating temperature of 200°F continuous (220°F peak).

    g. All wetted metal parts shall be constructed of 316 stainless steel.

    h. Analog outputs shall consist of non-interactive zero and span adjustments, a DC linearly of 0.1% of span, voltage output of 0-10 Vdc, and current output of 4-20 mA.

Q. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

R. Pressure Transducers.

1. Transducers shall have linear output signal and field-adjustable zero and span. Transducers shall be furnished with local display.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.
3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4–20 mA output, suitable mounting provisions, and block and bleed valves. – Transmitters shall be furnished with local display.
4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.)Transducer shall have 4–20 mA output, suitable mounting provisions, and 5-valve manifold. Transmitters shall be furnished with local display.

S. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

T. Gas shutoff valves. Unique double disc design with overtravel provides redundant sealing for leak tight shutoff. Visual indication of open and shut position. Fail closed. For on-off control of fuel gas in commercial and industrial gas burners. Aluminum body, 305 SS Core Tube, FM Approved to Class 7400 “liquid and gas safety shutoff valves”. Closes in less than 1 second.

U. Duct Mounted CO2 Sensors: Automated Logic NSB-AC9(orDC)D05-BB-LED-C with local display or approved equal.

V. Local Control Panels.

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
2. Wiring within the control panel shall be installed in a neat workman like manner. Wiring will be installed in Panduit. Color code the wiring from the controller to the end device. Inputs shall be installed using a White wire jacket, outputs shall be installed using a Blue wire jacket. Communication wiring will be installed using one common color throughout the building.
3. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs (Panduit). Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings. Furnish and install wire tags within the control panel to match the as-built drawings tag description.
4. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

3.6 Wiring and Raceways

A. General. Provide copper color coded wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 4 – INSTALLATION

4.1 INSTALLATION BY AUTOMATIC TEMPERATURE CONTROL (ATC) CONTRACTOR

A. The successful control contractor shall furnish and install all necessary electrical control wiring and conduit for the complete temperature control system, heating and ventilating equipment motor starting circuit controls and all electrical control interlocks for same, and for control wiring for miscellaneous HVAC equipment furnished by the Owner.

B. The ATC contractor shall furnish & install all necessary electrical control wiring and conduit of all temperature controls, heating and ventilating equipment motor starting circuit controls, all electrical control interlocks for same and for miscellaneous packaged equipment as defined within this specification. Full time Master, Journeyman and apprentice electricians shall be utilized for the installation.

C. All line and low voltage electrical and control wiring shall be installed **in 100% conduit, "WHITE", 3/4" minimum EMT**. The ATC system will be installed in 100% WHITE conduit & in accordance with the National Electrical Code and applicable local codes and in accordance with Division 26 of this specification. 3/4" nominal trade conduit shall be installed. When connecting to controllers, valves etc. that have no provisions for EMT connections, EMT may terminate in a junction box located within 36" of the controller or control valve. When making a transition between EMT and plenum cable, protect cable from abrasion by installing an insulating connector or equivalent on the exposed end of the EMT. Full time employees holding Master, Journeyman and apprentice electrician licenses in the State of Utah shall be utilized for the installation. **ALL ATC wiring shall be in 100% factory colored WHITE ¾" minimum conduit.** Painting conduit with brushes or spray cans before or after installation is not permitted.

D. All ATC rough-in boxes shall be identified with the letters "ATC" written across the inside of the box with permanent marker. In addition, each ATC cover plate shall be painted white with the letters "ATC" stenciled in black.

4.2 DUCT SMOKE DETECTORS

A. Duct smoke detectors are to be furnished and wired by Division 26. Detectors shall be installed by the ATC contractor. Detectors will be provided for the return air inlet.

B. Detectors shall be wired to allow monitoring by the DDC system as well as the fire alarm system.

1. Division 16 shall furnish & install a fire alarm/fan shutdown relay at each fan system. The ATC contractor shall wire between the alarm relay contacts and the fan system starter to lock out the supply fans when the building is in fire alarm.

C. Shutdown relay shall be wired to allow monitoring by the DDC System.

4.3 COMBINATION FIRE/SMOKE DETECTORS

A. Fire/smoke dampers are to be wired by Division 26. Detectors shall be provided and installed by Division 238000 contractor. Dampers shall be 120/1/60.

B. Division 26 shall furnish & install a fire alarm/fan shutdown relay at each fan system. The ATC contractor shall wire between the alarm relay contacts and the fan system starter to lock out the supply fans of the associated unit when the building is in fire alarm.

PART 5 – EXECUTION

5.1 Examination

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

B. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

5.2 Protection

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

5.3 Coordination

A. Engineer

1. Coordinate zone sensor requirements (Blank Plate, Digital Display, Setpoint Adjustment, Override, etc.) with engineer before installation of any zone sensors.

B. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

C. Test and Balance.

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 9000.
2. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
3. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
4. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

5.4 General Workmanship

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

5.5 Field Quality Control

A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 9000 Article 1.8 (Codes and Standards).

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

5.6 Wiring

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification, where the requirements of this section differ from Division 26, and the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.

C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.

D. **The ATC contractor shall provide a complete 100% 3/4" 'White' EMT conduit system for all system components.**

E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).

F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).

G. Do not install wiring in raceway containing tubing.

H. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

I. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

J. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.

K. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

L. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.

M. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

N. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

O. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).

P. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

Q. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

R. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

S. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

T. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft.) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

U. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

5.7 Communication Wiring

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling

B. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

C. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

D. All runs of communication wiring shall be unspliced length when that length is commercially available.

E. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

5.8 Identification of Hardware and Wiring

A. All junction boxes in mechanical spaces will be labeled "ATC" in large black lettering.

B. Label all timed override switches and local override switches with the associated equipment controlled.

C. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

D. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

E. Identifiers shall match record documents.

5.9 Controllers

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Section 251000 (Sequences of Operation).

5.10 Programming

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.

B. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation.

C. Operator Interface.

1. Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List in Section 23 9000. Label control points and data on the graphic with the descriptor that matches record documents.
2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

5.11 Control System Checkout and Testing

A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.

1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

2. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.

3. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

4. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

5. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.

6. Alarms and Interlocks:

    a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

5.12 Control System Demonstration and Acceptance

A. Demonstration.

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. Demonstrate that all of the documentation links are functioning properly and referenced to the correct document.
3. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.

4. Demonstrate compliance with Part 1, “System Performance.”
5. Demonstrate compliance with sequences of operation through all modes of operation.
6. Demonstrate complete operation of operator interface.
7. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

PART 6 – PROJECT COMPLETION

6.1 REQUIREMENTS

A. Upon completion of the project, the ATC contractor shall spend a minimum of 8 ON-SITE hours with the Duchesne School District maintenance personnel to adequately instruct them on the operation and maintenance of the system. These training sessions shall be scheduled at times convenient to the School District and shall be conducted at the project.

B. Provide (1) bond hard copy and (3) copies on CD Rom of the project operating and maintenance instruction manuals for use during the training sessions. Each manual shall contain all system components and DDC system programming.

C. Provide laminated as-built 11”x17” control drawings (flow diagram, panel drawings, etc.) in each control enclosure in mechanical spaces.

D. The ATC contractor shall provide as part of his contract the on-site services of a programmer familiar with the system for an additional 8 ON-SITE hours which the Engineer and/or the School District may use as they see fit to fine-tune or add features to the system.

E. Total hours to be provided by the ATC contractor (as described above) for instructions and fine tuning changes= 16 ON-SITE HOURS

F. Within 6 months of the close of warranty, provide a minimum of 8 ON-SITE hours to go through the system entirely and verify that the system is operating properly. In addition, replace any controls that are broken. These visits shall be scheduled at times convenient to the School District and shall be conducted at the project.

6.2 Cleaning

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

6.3 Training

A. Provide training for a designated staff of Owner’s representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods. Training requirements = 1 @ 4 hour formal training session of owner.

PART 7 – SEQUENCE OF OPERATION

7.1 Sequences of Operation

A. See Section 23, Appendix A (Sequences of Operation, With Points Lists).

B. Start-Up and Checkout Procedures

1. Start up, check out, and test all hardware and software and verify communication between all components.

    a. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
    b. Verify that all analog and binary input/output points read properly.
    c. Verify alarms and interlocks.
    d. Verify operation of the integrated system. 23 9000 Sequence of Operations for HVAC Controls

7.2 FIRE ALARM FAN SHUT-DOWN: (All Fan Systems)

A. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be “normally energized” and shall be installed by Division 16 at each fan system.

7.3 VARIABLE AIR VOLUME – TERMINAL UNITS

A. Run Conditions – Scheduled:
The unit shall run according to a user definable time schedule in the following modes:

1. Occupied Mode: The unit shall maintain

    a. A 74°F (adj.) cooling setpoint
    b. A 70°F (adj.) heating setpoint.

2. Unoccupied Mode (night setback): The unit shall maintain

    a. An 85°F (adj.) cooling setpoint.
    b. A 55°F (adj.) heating setpoint.

B. Alarms shall be provided as follows:

1. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
2. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

C. Zone Setpoint Adjust: -Coordinate with Engineer for all sensor requirements before installation begins. In some areas, the occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

D. Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

E. Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

F. Reversing Variable Volume Terminal Unit – Flow Control:
The unit shall maintain zone setpoints by controlling the airflow through one of the following:

G. Occupied: Defined as “during occupied hours and occupancy is sensed by the lighting control occupancy sensor”

1. When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
2. When the zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).
3. When zone temperature is less than its heating setpoint, the controller shall modulate heating to maintain the zone temperature at its heating setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum heating airflow (adj.) until the zone is satisfied.

H. Unoccupied: Defined as “during unoccupied hours and occupancy is NOT sensed by the lighting control occupancy sensor”

1. When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).
2. When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
3. When zone temperature is less than its unoccupied heating setpoint, the controller shall enable heating to maintain the zone temperature at the setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the auxiliary heating airflow (adj.) until the zone is satisfied.

I. Reheating Coil Valve:
The controller shall measure the zone temperature and modulate the reheating coil valve open on dropping temperature to maintain its heating setpoint.

J. Reheating – High Discharge Air Temperature Limit:
The controller shall measure the discharge air temperature and limit reheating if the discharge air temperature is more than 15°F (adj.) above the zone temperature.

K. Discharge Air Temperature:
The controller shall monitor the discharge air temperature.

L. Alarms shall be provided as follows:

1. High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
2. Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x		x
Zone Setpoint Adjust	x										x
Airflow	x								x		x
Discharge Air Temp	x								x		x
Zone Damper		x									x
Reheating Valve		x							x		x
Occupancy			X						x		X
Zone Override			x						x		X
Airflow Setpoint					x				x		x
Heating Mode						x			x		
Schedule								x			
Heating Setpoint									x		x
Cooling Setpoint									x		x
High Zone Temp										x	
Low Zone Temp										x	
High Discharge Air Temp										x	
Low Discharge Air Temp										x	

7.4 VARIABLE AIR VOLUME – AIR HANDLING UNITS – AHU-1 & 2

A. Run Conditions – Requested:
The unit shall run whenever:

1. Any zone is occupied.
2. OR a definable number of unoccupied zones need heating or cooling.

B. Freeze Protection:
The unit shall shut down as described below and generate an alarm upon receiving a freezestat status. The freezestat will be an automatic reset style safety. After a 5 minute (adj) delay, the AHU shall start again with the outside air damper closed. The unit will run until the mixed air is high enough to begin opening the economizer damper. The unit shall only be allowed to re-start (after freezestat trip) 3 times within 1 hour (adj) before the unit is locked out and a critical alarm will be sent to the operators.

C. High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.

D. Fire Alarm Shutdown:
The unit shall shut down and generate an alarm upon receiving a fire alarm shutdown command from the fire alarm system.

E. AHU Optimal Start:
The unit shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied setpoints. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures.

F. Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

G. Alarms shall be provided as follows:

1. Supply Fan Failure: Commanded on, but the status is off.
2. Supply Fan in Hand: Commanded off, but the status is on.
3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

H. Supply Air Duct Static Pressure Control:
The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based on zone cooling requirements.

1. The initial duct static pressure setpoint shall be 1.5in H2O (adj.).
2. As cooling demand increases, the setpoint shall incrementally reset up to a maximum of 1.8in H2O (adj.).
3. As cooling demand decreases, the setpoint shall incrementally reset down to a minimum of 1.3in H2O (adj.).

I. Alarms shall be provided as follows:

1. High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
2. Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
3. Supply Fan VFD Fault.

J. Return Fan:
The return fan shall run whenever the supply fan runs. The return fan VFD speed shall track the supply fan VFD speed as determined by the balancer. In addition, a differential pressure sensor shall bel locate in the return plenum (across the return air damper) and the VFD speed shall be overridden above the tracking offset if negative pressures are sensed at the damper DPT. This will ensure a positive return plenum.

K. Alarms shall be provided as follows:

1. Return Fan Failure: Commanded on, but the status is off.
2. Return Fan in Hand: Commanded off, but the status is on.
3. Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
4. Return Fan VFD Fault.

L. Building Static Pressure Control:
The controller shall measure building static pressure and modulate the relief air damper to maintain a building static pressure setpoint of 0.03in H2O (adj.)..

M. Alarms shall be provided as follows:

1. High Building Static Pressure: If the building air static pressure is 25% (adj.) greater than setpoint.
2. Low Building Static Pressure: If the building air static pressure is 25% (adj.) less than setpoint.

N. Supply Air Temperature Setpoint:
The supply air temperature setpoint shall be 55°F (adj.).

O. Cooling Coil Valve:
The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.

1. The cooling shall be enabled whenever:

    a. Outside air temperature is greater than 60°F (adj.).
    b. AND the economizer (if present) is disabled or fully open.
    c. AND the supply fan status is on.
    d. AND the heating (if present) is not active.
    e. The cooling coil valve shall open to 50% (adj.) whenever the freezestat (if present) is on.

2. Alarms shall be provided as follows:

    a. High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

P. Heating Coil Valve:
The controller shall measure the supply air temperature and modulate the heating coil valve to maintain its heating setpoint.

1. The heating shall be enabled whenever:

    a. Outside air temperature is less than 65°F (adj.).
    b. AND the supply fan status is on.
    c. AND the cooling (if present) is not active.

2. The heating coil valve shall open whenever:

    a. Supply air temperature drops from 40°F to 35°F (adj.).
    b. OR the freezestat (if present) is on.

3. Alarms shall be provided as follows:

    a. Low Supply Air Temp: If the supply air temperature is 5°F (adj.) less than setpoint.

Q. Economizer:
The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

R. The economizer shall be enabled whenever:

1. Outside air temperature is less than 65°F (adj.).
2. AND the outside air temperature is less than the return air temperature.
3. AND the supply fan status is on.

S. The economizer shall close whenever:

1. Mixed air temperature drops from 40°F to 35°F (adj.).
2. OR the freezestat (if present) is on.
3. OR on loss of supply fan status.

T. The outside and relief air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

U. Minimum Outside Air Ventilation – Carbon Dioxide (CO2) Control:
When in the occupied mode, the controller shall measure the return air CO2 levels and modulate the outside air dampers open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of 750 ppm (adj.).

1. Alarms shall be provided as follows:

    a. High Return Air Carbon Dioxide Concentration: If the return air CO2 concentration is greater than 1000ppm (adj.) when in the unit is running.

V. Mixed Air Temperature:
The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

W. Alarms shall be provided as follows:

1. High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.).
2. Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.).

X. Return Air Temperature:
The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).

Y. Alarms shall be provided as follows:

1. High Return Air Temp: If the return air temperature is greater than 90°F (adj.).
2. Low Return Air Temp: If the return air temperature is less than 45°F (adj.).

Z. Supply Air Temperature:
The controller shall monitor the supply air temperature.

AA. Alarms shall be provided as follows:

1. High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).
2. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Air Static Pressure	x								x	x	x
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Temp	x								x		x
Return Plenum Pressure	X								x	x	x
Supply Air Temp	x								x		x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Fan VFD Speed		x							x		x
Return Fan VFD Speed		x							x		x
Cooling Valve		x							x		x
Heating Valve		x							x		x
Mixed Air Dampers		x							x		x
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Fire Alarm Shutdown			x						x	x	x
Supply Fan VFD Fault			x							x	x
Supply Fan Status			x						x		x
Return Fan VFD Fault			x							x	x
Return Fan Status			x						x		x
Supply Fan Start/Stop				x					x		x
Return Fan Start/Stop				x					x		x
Supply Air Static Pressure Setpoint					x				x		x
Building Static Pressure Setpoint					x						x
Supply Air Temp Setpoint					x				x		x
Economizer Mixed Air Temp Setpoint					x				x		x
RA Carbon Dioxide PPM Setpoint					x				x		x
High Supply Air Static Pressure										x	
Low Supply Air Static Pressure										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	
Supply Fan Runtime Exceeded										x	
High Building Static Pressure										x	
Low Building Static Pressure										x	
Return Fan Failure										x	
Return Fan in Hand										x	
Return Fan Runtime Exceeded										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	
Prefilter Change Required										x	x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
High Mixed Air Temp										x	
Low Mixed Air Temp										x	
High Return Air Carbon Dioxide Concentration										x	
High Return Air Temp										x	
Low Return Air Temp										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	

7.5 SINGLE ZONE AIR HANDLING UNITS – AHU -3,4,5, & 6

A. Run Conditions – Scheduled:
The unit shall run according to a user definable time schedule in the following modes:

1. Occupied Mode: The unit shall maintain

    a. A 74°F (adj.) cooling setpoint
    b. A 70°F (adj.) heating setpoint.

2. Unoccupied Mode (night setback): The unit shall maintain

    a. An 85°F (adj.) cooling setpoint.
    b. A 55°F (adj.) heating setpoint.

B. Alarms shall be provided as follows:

1. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
2. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

C. Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints from the front end. Provide protective thermostat guards or return air sensors as coordinated with Engineer.

D. Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

E. Zone Unoccupied Override: -
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

F. Freeze Protection:
The unit shall shut down as described below and generate an alarm upon receiving a freezestat status. The freezestat will be an automatic reset style safety. After a 5 minute (adj) delay, the AHU shall start again with the outside air damper closed. The unit will run until the mixed air is high enough to begin opening the economizer damper. The unit shall only be allowed to re-start (after freezestat trip) 3 times within 1 hour (adj) before the unit is locked out and a critical alarm will be sent to the operators.

G. Fire Alarm Shutdown:
The unit shall shut down and generate an alarm upon receiving a fire alarm shutdown command from the fire alarm system.

H. High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.

I. Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime. Once enabled, the supply fan shall ramp to minimum speed as set by the balancer.

1. Alarms shall be provided as follows:
2. Supply Fan Failure: Commanded on, but the status is off.
3. Supply Fan in Hand: Commanded off, but the status is on.
4. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

J. Return Fan:
The return fan shall run whenever the supply fan runs.

1. Alarms shall be provided as follows:

    a. Return Fan Failure: Commanded on, but the status is off.
    b. Return Fan in Hand: Commanded off, but the status is on.
    c. Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
    d. Return Fan VFD Fault.

K. Building Static Pressure Control:
The controller shall measure building static pressure and modulate the return fan VFD speed to maintain a building static pressure setpoint of +0.03in H2O (adj.) The return fan VFD speed shall not drop below 20% (adj.). The relief air damper shall track the outside air damper position.

1. Alarms shall be provided as follows:

    a. High Building Static Pressure: If the building air static pressure is 25% (adj.) greater than setpoint.
    b. Low Building Static Pressure: If the building air static pressure is 25% (adj.) less than setpoint.

L. Cooling:
The controller shall measure the zone temperature and modulate the cooling coil valve to maintain its cooling setpoint. If the cooling valve is 100% open and the space temperature is above setpoint for 5 minutes (adj), the supply fan shall modulate up to maintain space temperature setpoint. The reverse shall occur when the space temperature setpoint is satisfied.

1. The cooling shall be enabled whenever:

    a. Outside air temperature is greater than 60°F (adj.).
    b. AND the economizer (if present) is disabled or fully open.
    c. AND the zone temperature is above cooling setpoint.
    d. AND the supply fan status is on.
    e. AND the heating is not active.

2. The cooling coil valve shall open to 50% (adj.) whenever the freezestat (if present) is on.

M. Heating:
The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint. If the heating valve is 100% open and the space temperature is below setpoint for 5 minutes (adj), the supply fan shall modulate up to maintain space temperature setpoint. The reverse shall occur when the space temperature setpoint is satisfied.

1. The heating shall be enabled whenever:

    a. Outside air temperature is less than 65°F (adj.).
    b. AND the zone temperature is below heating setpoint.
    c. AND the supply fan status is on.
    d. AND the cooling is not active.

2. The heating coil valve shall open whenever the freezestat (if present) is on.

N. Economizer:
The controller shall measure the zone temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F less than the zone cooling setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

1. The economizer shall be enabled whenever:

    a. Outside air temperature is less than 65°F (adj.).
    b. AND the outside air temperature is less than the return air temperature.
    c. AND the supply fan status is on.

2. The economizer shall close whenever:

    a. Mixed air temperature drops from 45°F to 40°F (adj.).
    b. OR on loss of supply fan status.
    c. OR the freezestat (if present) is on.

O. The outside and relief air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available, the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

P. Minimum Outside Air Ventilation – Carbon Dioxide (CO_2) Control:
When in the occupied mode, the controller shall measure the return air CO_2 levels and modulate the outside air dampers open on rising CO_2 concentrations, overriding normal damper operation to maintain a CO_2 setpoint of 750 ppm (adj.).

Q. Return Air Carbon Dioxide (CO2) Concentration Monitoring:
The controller shall measure the return air CO2 levels.

1. Alarms shall be provided as follows:

    a. High Return Air Carbon Dioxide Concentration: If the return air CO2 concentration is greater than 1000ppm (adj.) when in the occupied mode.

R. Mixed Air Temperature:
The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

1. Alarms shall be provided as follows:

    a. High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.).
    b. Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.).

S. Return Air Temperature:
The controller shall monitor the return air temperature and use as required for economizer control (if present).

1. Alarms shall be provided as follows:

    a. High Return Air Temp: If the return air temperature is greater than 90°F (adj.).
    b. Low Return Air Temp: If the return air temperature is less than 45°F (adj.).

T. Supply Air Temperature:
The controller shall monitor the supply air temperature.

1. Alarms shall be provided as follows:

    a. High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).
    b. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Building Static Pressure	x								x		x
Mixed Air Temp	x								x		x
Return Air Carbon Dioxide PPM	x								x		x
Return Air Temp	x								x		x
Supply Air Temp	x								x		x
Space Temperature	X								X		x
Supply Fan VFD Speed		x							x		x
Return Fan VFD Speed		x							x		x
Cooling Valve		x							x		x
Heating Valve		x							x		x
Mixed Air Dampers		x							x		x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Fire Alarm Shutdown			x						x	x	x
Supply Fan VFD Fault			x							x	x
Supply Fan Status			x						x		x
Return Fan VFD Fault			x							x	x
Return Fan Status			x						x		x
Supply Fan Start/Stop				x					x		x
Return Fan Start/Stop				x					x		x
Building Static Pressure Setpoint					x						x
Supply Air Temp Setpoint					x				x		x
Zone Temp Setpoint					X				X		x
Economizer Mixed Air Temp Setpoint					x				x		x
RA Carbon Dioxide PPM Setpoint					x				x		x
Supply Fan Failure										x	
Supply Fan in Hand										x	
Supply Fan Runtime Exceeded										x	
High Building Static Pressure										x	
Low Building Static Pressure										x	
Return Fan Failure										x	
Return Fan in Hand										x	
Return Fan Runtime Exceeded										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	
Prefilter Change Required										x	x
High Mixed Air Temp										x	
Low Mixed Air Temp										x	
High Return Air Carbon Dioxide Concentration										x	
High Return Air Temp										x	
Low Return Air Temp										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	

7.6 ROOF TOP UNITS – DX COOLING WITH GAS HEAT

A. The packaged rooftop unit shall operate under its own factory controls and shall be enabled and disabled by the BMS according to the occupancy schedules with morning warm-up.

B. In occupied mode, the packaged rooftop unit shall run continuously. Heating and cooling shall be maintained thru a wall mounted temperature sensor to the adjustable setpoint.

C. In unoccupied mode, the rooftop unit shall cycle to maintain after hours heating setpoint.

D. Provide BACnet MS/TP Integration to units. Coordinate with DCSD for control points to display on graphic.

	Hardware Points				BACnet Integration Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp					x				x		x
Zone Temp					x				x		x
Zone Setpoint Adjust					x						x
Mixed Air Temp					x				x		x
Return Air Temp					x				x		x
Supply Air Temp					x				x		x
Mixed Air Dampers					x				x		x
Zone Override					X				x		x
Supply Air Smoke Detector						x			x	x	x
Supply Fan Status						x			x		x
Supply Fan Start/Stop						x			x		x
Cooling Stages						x			x		x
Economizer Zone Temp Setpoint					x				x		x
Schedule								x			
Heating Setpoint									x		x
Cooling Setpoint									x		x
High Zone Temp										x	
Low Zone Temp										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	
Supply Fan Runtime Exceeded										x	
Compressor Runtime Exceeded										x	
High Mixed Air Temp										x	
Low Mixed Air Temp										x	
High Return Air Temp										x	
Low Return Air Temp										x	
High Supply Air Temp										x	

	Hardware Points				BACnet Integration Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Low Supply Air Temp										x	

7.7 ROOFTOPS UNITS (DOAS)– DX COOLING w/ HOT WATER COILS

A. The packaged rooftop unit shall operate under its own factory controls and shall be enabled and disabled by the BMS according to the occupancy schedules with morning warm-up.

B. In occupied mode, the packaged rooftop unit shall run continuously. Heating and cooling shall be maintained thru a wall mounted temperature sensor to the adjustable setpoint

C. In unoccupied mode, the rooftop unit shall cycle to maintain heating setpoint.

D. Provide BACnet MS/TP Integration to units. Coordinate with DCSD for control points to display on graphic.

7.8 EXHAUST FANS – SEE SCHEDULE FOR VARIOUS REQUIREMENTS AND CONTROL METHODS

A. **COOLING EXHAUST FANS**

1. The unit shall be continuously enabled to maintain a zone temperature cooling setpoint of 78°F (adj.) – No occupancy schedule. If the zone temperature is greater than the cooling setpoint by 3 deg F (adj.) an alarm shall be set to the front end.

B. **LOCKER ROOM EXHASUT FANS**

1. Occupied: exhaust fans are to run continuously

2. Unoccupied: exhaust fans are to shut off.

C. **GENERAL EXHAUST FANS**

1. The unit shall be continuously enabled during occupied mode. If the zone temperature is greater than the cooling setpoint by 3 deg F (adj.) an alarm shall be set to the front end.

D. **EXHAUST FANS W/ TIMER SWITCHES**

1. Furnish and install a 0-2hour override switch as shown on the drawings to control exhaust fans. Clearly label the switch indicating the equipment being controlled. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

E. **DRYER EXHAUST FAN**

1. Interlock exhaust fan with dryer. Furnish and install pressure switch with time delay relay to keep the exhaust fan enabled after the dryer is disabled. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

F. **DISHWASHER EXHAUST FAN**

1. Interlock exhaust fan with dishwasher enable switch. Furnish and install a 0-2 hour time delay relay to keep the exhaust fan enabled after the dishwasher is disabled. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

G. **METAL & WOOD SHOPS GENERAL EXHAUST FANS**

1. Furnish and install a 0-2 hour timer switch to control the exhaust fans.

2. Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.

3. Switch controlling exhaust fan in wood shop to be located on wall. Coordinate location with owner

4. Switch controlling exhaust fab in metal shop to be located in control make up air control panel. See detail 1/M4.5

H. **WELDING STATIONS EXHAUST FAN**

1. Interlock exhaust fan with make-up air unit. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

2. See section welding exhaust/makeup system for interlocking exhaust fans and makeup air unit.

I. **WELDING EXHAUST/MAKEUP SYSTEM**

1. EXHAUST FAN: ON-OFF switches for each fan shall be located in a control panel in the area and shall start each of the two exhaust fans. When any exhaust fan is running, the area make-up unit shall start & be controlled by a remote panel furnished with the unit. Remote panel shall be mounted in the same location as the exhaust fan control cabinet. The make-up air unit shall be interfaced with each exhaust fan and its internal VFD shall increase its speed for each fan that is running (2 step – 6,000 CFM; and 12,000 CFM). ATC contractor shall wire system according to instructions furnished by the equipment manufacturer.

J. **BOILER ROOM VENTILATION CONTROL**

1. A room temperature sensor, acting through a DDC controller shall cycle ventilation fan VF-1 to maintain desired boiler room temperature. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

K. **TOILET ROOM EXHAUST FANS**

1. Ceiling mounted, toilet room exhaust fans shall be individually operated by pre-determined schedules from the building DDC system.

2. Roof mounted, toilet room exhaust fans shall be individually operated by pre-determined schedules from the building DDC system. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

L. **ELECTRICAL ROOM VENTILATION FAN CONTROL**

1. Exhaust fan shall be cycled by an electric, cooling type, wall thermostat with dial adjustment. Room temperature shall be monitored through the building DDC system and Lan Network. Electrical room with roof hoods with ATC dampers shall interlock damper to open when exhaust fan is operating. (Fan on/off status and proof of flow from a current sensor shall be monitored by the BMS.)

M. **JANITORS ROOM EXHAUST FAN CONTROL**

1. Each janitor's room exhaust fan shall be individually controlled as programmed in the building DDC system.

N. **CLOTHES DRYER VENT BOOSTER FANS**

1. Interlock booster fan so that it starts when any of the dryers it serves are started. This is accomplished by installing a pressure switch with time delay 120 VAC feed serving the dryer(s) and setting its sensitivity so that its relay contacts are energized when dryers are started.

O. **Typical Exhaust Fan Point Schedule.**

1)

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x		x
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Cooling Setpoint					x				x		x
High Zone Temp										x	
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	

7.9 UNIT HEATERS

A. **UNIT HEATER - WATER**

1. Run Conditions – Scheduled:
   The unit shall run according to a user definable time schedule in the following modes:

   a. Occupied Mode: The unit shall maintain a heating setpoint of 70°F (adj.).
   b. Unoccupied Mode (night setback): The unit shall maintain a heating setpoint of 65°F (adj.).

2. Fan:
   The fan shall run anytime the zone temperature drops below heating setpoint, unless shutdown on safeties.

3. Heating Coil Valve:
   The controller shall measure the zone temperature and opens the heating coil valve to maintain its heating setpoint.

4. The heating shall be enabled whenever:

    a. Outside air temperature is less than 65°F (adj.).
    b. AND the zone temperature is below heating setpoint.
    c. AND the fan is on.

5. Fan Status:
   The controller shall monitor the fan status.

6. Alarms shall be provided as follows:

    a. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).Fan Failure: Commanded on, but the status is off.
    b. Fan in Hand: Commanded off, but the status is on.
    c. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x		x
Heating Valve				x					x		x
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Schedule								x			
Heating Setpoint									x		x
Low Zone Temp										x	
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	

B. **UNIT HEATERS – Electric**

1. Electric unit heaters & electric wall heaters shall be controlled thru their own internal thermostat and monitored with a room temperature sensor reading to the BMS.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x		x
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Heating Setpoint									x		x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Low Zone Temp										x	
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	

7.10 PACKAGED SPLIT SYSYEM HEAT-PUMP UNITS – AC-1 & AC-2 UNITS

1. Run Conditions - Continuous:

2. The packaged air conditioning unit shall operate thru its own factory controls and integral thermistor. A hard wired, wall mounted, remote thermostat shall be installed where shown on the drawings for remote control of the unit. Unit shall cycle to maintain space temperature cooling setpoint.
3. The controls contractor shall provide a wall mounted temperature sensor to monitor space temperature. An alarm shall be sent to the BMS should the temperature rise 10°F above setpoint (adjustable).
    a. Alarms shall be provided as follows:

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x	x	x

7.11 HW/CHW FAN COIL UNITS

1. Run Conditions - Scheduled:
   The unit shall run according to a user definable time schedule in the following modes:

    a. Occupied Mode: The unit shall maintain

        1) A 74°F (adj.) cooling setpoint
        2) A 70°F (adj.) heating setpoint.

    b. Unoccupied Mode (night setback): The unit shall maintain

        1) An 85°F (adj.) cooling setpoint.
        2) A 55°F (adj.) heating setpoint.

c. Alarms shall be provided as follows:

1) High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
2) Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

2. Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor. Coordinate with Engineer for all sensor requirements.

3. Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

4. Fan:
The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

5. Cooling Coil Valve:
The controller shall measure the zone temperature and modulate the cooling coil valve to maintain its cooling setpoint.

a. The cooling shall be enabled whenever:

1) Outside air temperature is greater than 60°F (adj.).
2) AND the zone temperature is above cooling setpoint.
3) AND the fan is on.

6. Heating Coil Valve:
The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.

a. The heating shall be enabled whenever:

1) Outside air temperature is less than 65°F (adj.).
2) AND the zone temperature is below heating setpoint.
3) AND the fan is on.

7. Fan Status:
The controller shall monitor the fan status.

a. Alarms shall be provided as follows:

1) Fan Failure: Commanded on, but the status is off.
2) Fan in Hand: Commanded off, but the status is on.
3) Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Temp	x								x		x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Zone Setpoint Adjust	x										x
Discharge Air Temp	X								X		x
Cooling Valve		x							x		x
Heating Valve		x							x		x
Zone Override			x						x		x
Fan Status			x								x
Fan Start/Stop				x					x		x
Schedule								x			
Heating Setpoint									x		x
Cooling Setpoint									x		x
High Zone Temp										x	
Low Zone Temp										x	
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	

7.12 KITCHEN CONTROLS

1. Install the remote control panel furnished by make-up air unit manufacturer in a recessed ATC panel see detail 1/M6.9 for clarification. Interlock make-up air units with kitchen exhaust hood fans and wire them to stop upon kitchen hood fire sprinkler activation. This panel shall incorporate the make-up air unit control panels, and in addition shall have fan switches and pilot lights for control of kitchen hood fans. Provide an "on-off" switch and pilot light in the control panel to control the dishwasher fan. In addition, a DDC interface to the District shall be provided to indicate operational status and discharge temperature of each makeup unit.
2. Provide a heat sensor in each hood section. When activated, sensor shall energize MUA units and hood exhaust fans. Once activated, the exhaust hood fan shall run for 1 hour. After hood is disabled, verify the heat sensor is below activation setpoint and keep hood fan off. If the heat sensor is above activation setpoint, enable the hood fan and run it for 1 hour. Repeat this sequence until the heat sensor is below activation setpoint.
3. All natural gas supplied to the kitchen shall be shut off upon kitchen hood fire suppression system is activated. This shall be done by mechanical means. Mechanical gas valve(s) shall be provided by ATC contractor. See plumbing drawings for requirements. Monitor gas emergency switches and alarm district upon activation.
4. Upon actuation of the kitchen hood fire extinguishing system a flow switch (provided with the fire system) shall be actuated causing the line size automatic gas valve to close. This valve shall remain closed until manually reset by a "KITCHEN NATURAL GAS: OFF-NORMAL" indicator switch with a pilot light. This reset unit shall be located at the make-up air unit control panels. The pilot light shall indicate that the valve has been closed by the emergency circuit.

5. The ATC contractor shall perform a field test of this system and provide a letter of certification to the Architect that the system functions as specified.
6. Provide DDC temperature sensor for each freezer and cold storage area. An alarm to the District remote security facility through the LAN Network shall be generated whenever temperatures drop below or above the owner determined limits.
7. Provide an interlock to control the dishwasher exhaust fan with an on/auto switch or be tied into dishwasher. The exhaust fan shall run when the dishwasher and booster heater are operating.
8. Main kitchen shall be provided with separate occupancy schedule and points as required by owner.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Kitchen Temp	x								x		x
Freezer Temp	x								x		x
Cooler Temp	x								x		x
MAU Discharge Air Temp	X								x		x
Heat Sensor Made			x						x		x
MAU Fan Status			x								x
Kitchen Gas Switch Positions			X							X	x
Exhaust Fans Status			x						x		x
MAU Fan Start/Stop				x					x		x
Gas Valve Emergency Switch			X							X	x
Schedule								x			
High Zone Temp										x	
Low Zone Temp										x	
Fan Failure										x	
Fan in Hand										x	

7.13 DOMESTIC HOT WATER SYSTEMS

1. There are two domestic hot water heating systems (Mechanical 107 and Existing); 120 deg. F & 140deg. F. Systems consist of a hot water heaters, storage tank and recirculation pumps.
2. When the building is in OCCUPIED mode, the 120 deg. F. system hot water heater shall be enabled & the recirculating pump shall run 24/7.
3. When the kitchen is in use, the 140 deg. F. system hot water heater shall be enabled. The recirculation pump shall run 24/7.
4. Redundant domestic water recirculation pumps shall be programmed to run lead/lag with adjustable run times.
5. Once enabled by the DDC system, the domestic hot water heater shall operate under factory supplied controls.
6. Monitor both systems supply water temperatures.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
110 F Temp	x								x		x
140 F Temp	x								x		x
Storage Tank Temp	X								x		x
Water Heater Alarm (Each)			x						x		x
Circ Pump Status (Each)			x								x
Combustion Air Damper (Each)				X							x
Water Heater Enable (Each)				X							x
Water Heater Status (Each)			X							X	x
Combustion Air Dmpr Open (Each)			X							x	x
EPO/EVO Switch Positions			X							X	x
Schedule								x			
Heating Setpoint									x		x
Cooling Setpoint									x		x
Water Heater Failure (Each)										X	
High 110 F Temp										x	
Low 110 F Temp										x	
High 140 F Temp										x	
Low 140 F Temp										x	
Pump Runtime Exceeded										x	

7.14 VESTIBULE CONTROL – FIN TUBE & ELECTRICAL CEILING PANEL

1. Run Conditions - Continuous:
   The unit shall run according to a user definable time schedule in the following modes:

   a. Vestibule Occupied Mode: The unit shall maintain
      1) A 70°F (adj.) heating setpoint.
   b. Vestibule Unoccupied Mode (night setback): The unit shall maintain
      1) A 55°F (adj.) heating setpoint.
   c. Vestibule Ceiling : The unit shall maintain
      1) A 65°F (adj.) heating setpoint.
   d. Alarms shall be provided as follows:
      1) Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
      2) High Zone Temp: If the zone temperature is greater than the heating setpoint by a user definable amount (adj.).

2. Hot water fin tube radiators located above the vestibule ceiling will be controlled by a zone sensor acting through a DDC controller located in the ceiling space. The finned tube radiation heating valve shall open whenever the ceiling temperature falls below setpoint and shall remain open until the ceiling space is 5 Deg F above setpoint.

3. The electric ceiling panels will be controlled by a flat plate zone sensor acting through a DDC controller located in the vestibule space. The electric heater shall be enabled whenever the zone temperature falls below setpoint and shall remain open until the space is 5 Deg F above setpoint

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Vestibule Ceiling Temp	x								x		x
Vestibule Temp	x								x		x
Electric Rad Panel – Enable				X					x		x
Vestibule Ceiling Control Valve				X					x		x
Schedule								x			
Heating Setpoint									x		x
Cooling Setpoint									x		x
High Ceiling Temp										x	
Low Ceiling Temp										x	
High Vestibule Temp										x	
Low Vestibule Temp										x	
Pump Runtime Exceeded										x	

7.15 BOILER ROOM UNIT HEATER CONTROL

1. A room temperature sensor, acting through a DDC controller, shall cycle unit heater fan and gas heat to maintain desired boiler room space temperature.

2. Temperature sensor is also tied into the boiler room ventilation fan VF-1.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Boiler Room Temp	x								x		x
Unit Heater Status			X						x		x
Unit Heater Gas Valve				X					x		x
Unit Heater Fan				X					X		x
Heating Setpoint									x		x
Low Room Temp										x	
High Room Temp										x	

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Pump Runtime Exceeded										x	

7.16 GLYCOL FEED SYSTEM ALARM (GF-1 & 2 & SMGF-1- SNOWMELT)

1. When glycol feed tank in alarm, an alarm shall be sent to the District through the LAN Network.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
GF-1 Alarm			x							x	x
GF-2 Alarm			x							x	x
SMGF-1 Alarm			x							x	x

7.17 BOILER ROOM COMBUSTION AIR DAMPER:

1. Motorized spring type dampers shall open when activated by gas burners from B-1, B-2, B-E, or VF-1 damper. Damper shall fail closed upon loss of signal or power. Provide damper status at each damper.
2. Damper section shall also open as needed for VF-1 ventilation fan.
3. Boilers shall not fire until proof of combustion air damper open is provided. This shall be provided for both manual and auto modes.

7.18 CHILLED WATER SYSTEM - FINAL

1. Chiller - Run Conditions:
   The chillers shall be enabled to run whenever:

   a. A definable number of chilled water coils need cooling
   b. AND the outside air temperature is greater than 54°F (adj.).

2. To prevent short cycling, the chiller shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.

3. The chiller shall run subject to its own internal safeties and controls.

4. Chilled Water Pump Operation:
   The two chilled water pumps (1 primary and 1 secondary) shall run anytime the chiller is called to run. The chilled water pump shall also run for freeze protection whenever the outside air temperature is less than a user definable setpoint (adj.).

   a. The lead pump shall start prior to the chiller being enabled and shall stop only after the chiller is disabled. The pump(s) shall therefore have:

      1) A user adjustable delay on start.
      2) AND a user adjustable delay on stop.

b. The delay times shall be set appropriately to allow for orderly chilled water system start-up, shutdown and sequencing.

c. The two pumps (1.1 with 1.2 and 2.1 with 2.2) shall operate in a lead/standby fashion.

1) The lead pump shall run first.
2) On failure of the lead pump, the standby pump shall run and the lead pump shall turn off.

5. The designated lead pump shall rotate upon one of the following conditions (user selectable):

a. manually through a software switch
b. if pump runtime (adj.) is exceeded
c. daily
d. weekly
e. monthly

6. Alarms shall be provided as follows:

a. Chilled Water Pump 1.1/2.1

1) Failure: Commanded on, but the status is off.
2) Running in Hand: Commanded off, but the status is on.
3) Runtime Exceeded: Status runtime exceeds a user definable limit.
4) VFD Fault.

b. Chilled Water Pump 1.2/2.2

1) Failure: Commanded on, but the status is off.
2) Running in Hand: Commanded off, but the status is on.
3) Runtime Exceeded: Status runtime exceeds a user definable limit.
4) VFD Fault.

7. Chilled Water Differential Pressure Control:
The controller shall measure chilled water differential pressure and modulate the lead secondary (2.1 or 2.2) chilled water pump VFD to maintain its chilled water differential pressure setpoint. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

8. The controller shall modulate chilled water pump speed to maintain a chilled water differential pressure of 12in H2O (adj.). The VFD minimum speed shall not drop below 10% (adj.).

a. Alarms shall be provided as follows:

1) High Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) greater than setpoint.
2) Low Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) less than setpoint.

9. Chilled Water Supply Temperature - Setpoint Reset:
The chilled water supply temperature setpoint shall reset using a trim and respond algorithm based on cooling requirements.

a. The chilled water supply temperature setpoint shall reset to a lower value as the facility's chilled water valves open beyond a user definable threshold (90% open, typ.). Once the chilled water coils are satisfied (valves closing) then the chilled water supply temperature setpoint shall gradually rise over time to reduce cooling energy use.

b. Chilled Water Temperature Monitoring:
The following temperatures shall be monitored:

1) Chilled water supply (each chiller)
2) Chilled water return (each chiller)

c. Alarms shall be provided as follows:

1) High Chilled Water Supply Temp: If the chilled water supply temperature is greater than 55°F (adj.).
2) Low Chilled Water Supply Temp: If the chilled water supply temperature is less than 38°F (adj.).

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Chilled Water Differential Pressure	x								x		x
Main Chilled Water Return Temp	x								x		x
Main Chilled Water Supply Temp	x								x		x
Chiller-1 Water Supply Temp	x								x		x
Chiller-1 Water Return Temp	x								x		x
Chilled Water Pump-2.1 VFD Speed		x							x		x
Chilled Water Pump-2.2 VFD Speed		x							x		x
Chilled Water Supply Temp Setpoint Reset		x							x		x
Chilled Water Pump x.x Status			x						x		x
Chilled Wtr Pmp 2.x VFD Fault						x				x	x
Chiller Status			x						x		x
Chilled Water Pmp x.x Start/Stop				x					x		x
Chiller-Enable				x							x
Outside Air Temp	x										x
Outside Air Humidity	X										x
Chilled Water Differential Pressure Setpoint					x				x		x
Chilled Water Flow Setpoint					x				x		x
Chilled Water Isolation Valve Failure										x	

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Chilled Water Isolation Valve in Hand										x	
Chilled Water Isolation Valve Runtime Exceeded										x	
Chilled Water Pump Failure										x	
Chilled Water Pump 2 Failure										x	
Chilled Water Pump Running in Hand										x	
Chilled Water Pump Runtime Exceeded										x	
High Chilled Water Differential Pressure										x	
Low Chilled Water Differential Pressure										x	
Low Chilled Water Flow										x	
Chiller Failure										x	
Chiller Running in Hand										x	
Chiller Runtime Exceeded										x	
High Chilled Water Supply Temp										x	
Low Chilled Water Supply Temp										x	

10. Chiller Interface Monitor:
    Current chiller status and operating conditions will be monitored through its communications interface port. The interface at a minimum will monitor and trend the points as shown on the Points List. Additional points will be available through the interface, coordinate with DCSD for required points shown on graphics, alarmed, trended, etc.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Chiller kW					x				x		x
Chilled Water Supply Temp Setpoint					x				x		x
Operating Hours					x						x
Chilled Water Supply Temp					x				x		x
Chilled Water Return Temp					x				x		x
Refrigerant Pressure					x				x		x
Oil Differential Pressure					x				x		x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Oil Temp					x				x		x
Chiller Status						x			x		x
Chiller Alarms						X				x	x
Compressor Status (each if avail)						X			X		x
Condenser Fan STS (each if avail)						X			X		x
Chilled Water Flow Status						x			x		x

7.19 HOT WATER SYSTEM - FINAL

1. Boiler System Run Conditions:
   The boiler system shall be enabled to run whenever:

   a. A definable number of hot water coils need heating.

   b. AND outside air temperature is less than 65°F (adj.).

   c. AND the associated combustion air damper is proven open.

      1) To prevent short cycling, the boiler system shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.
      2) The boiler shall run subject to its own internal safeties and controls.
      3) The boiler system shall also run for freeze protection whenever the outside air temperature is less than 38°F (adj.).
      4) The boiler shall not be allowed to start until the associated combustion air damper is proven open. The combustion air damper must open before any boiler is allowed to start, even when overridden by the local manual override relays.

2. Hot Water Isolation Valve:
   The valve shall open anytime the associated Boiler is called to run.

   a. The valve shall open prior to the Boiler being enabled and shall close only after the Boiler is disabled. The valve shall therefore have:

      1) A user adjustable delay on start.
      2) AND a user adjustable delay on stop.

3. The delay times shall be set appropriately to allow for orderly Hot water system start-up, shutdown and sequencing.

   a. Alarms shall be provided as follows:

      1) Failure: Valve commanded open but the status indicates closed.
      2) Open in Hand: Valve commanded closed but the status indicates open.

3) Runtime Exceeded: Valve status runtime exceeds a user-definable limit.

4. Combustion Air Dampers.
   Upon a call for heating water, the combustion air damper shall open. Once proven open by an end switch, the boiler shall be enabled.

5. Hot Water Booster Pump Operation: (P-3 and P-4)
   The hot water booster pumps shall operate any time the associated boiler is enabled.

   a. The boiler shall send a signal to start the booster pump.
   b. The BAS will monitor pump status and alarm upon failure.

6. Secondary Hot Water Pump Lead/Lag Operation: (P-5.1 & P-5.2)
   The two hot water pumps shall operate in a lead/lag fashion.

   a. The lead pump shall run first.
   b. On failure of the lead pump, the lag pump shall run and the lead pump shall turn off.
   c. On decreasing hot water differential pressure, the lag pump shall stage on and run in unison with the lead pump to maintain hot water differential pressure setpoint.

7. The designated lead pump shall rotate upon one of the following conditions (user selectable):

   a. manually through a software switch
   b. if pump runtime (adj.) is exceeded
   c. daily
   d. weekly
   e. monthly

8. Alarms shall be provided as follows:

   a. Hot Water Pump 5.1

      1) Failure: Commanded on, but the status is off.
      2) Running in Hand: Commanded off, but the status is on.
      3) Runtime Exceeded: Status runtime exceeds a user definable limit.
      4) VFD Fault.

   b. Hot Water Pump 5.2

      1) Failure: Commanded on, but the status is off.
      2) Running in Hand: Commanded off, but the status is on.
      3) Runtime Exceeded: Status runtime exceeds a user definable limit.
      4) VFD Fault.

9. Hot Water Differential Pressure Control:
   The controller shall measure hot water differential pressure and modulate the hot water pump VFDs in sequence to maintain its hot water differential pressure setpoint.

   a. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

   b. The controller shall modulate hot water pump speeds to maintain a hot water differential pressure of 10in H2O (adj.). The VFDs minimum speed shall not drop below 20% (adj.).

c. On dropping hot water differential pressure, the VFDs shall stage on and run to maintain setpoint as follows:

1) The controller shall modulate the lead VFD to maintain setpoint.
2) If the lead VFD speed is greater than a setpoint of 90% (adj.), the lag VFD shall stage on.
3) The lag VFD shall ramp up to match the lead VFD speed and then run in unison with the lead VFD to maintain setpoint.

d. On rising hot water differential pressure, the VFDs shall stage off as follows:

1) If the VFDs speeds drops back to 60% (adj.) below setpoint, the lag VFD shall stage off.
2) The lead VFD shall continue to run to maintain setpoint.

e. Alarms shall be provided as follows:

1) High Hot Water Differential Pressure: If 25% (adj.) greater than setpoint.
2) Low Hot Water Differential Pressure: If 25% (adj.) less than setpoint.

10. Boiler Operation:
The tow boilers shall operate in a lead/lag fashion.

a. The lead boiler shall run first. Each boiler will have an isolation valve and associated pump provided by the ATC contractor. This valve must prove open before the boiler is allowed to start.

b. On failure of the lead boiler, the designated lag boiler shall run and the lead boiler shall turn off.

c. The boilers, under their own internal controls, will modulate to maintain the primary hot water temperature setpoint of 180 F (adj).

d. As primary hot water supply temperature drops 10 Deg F (adj.) below setpoint, the next boiler in the sequencer shall stage on and run in unison with the other boiler(s) to maintain hot water temperature setpoint.

e. As the primary hot water supply temperature rises back to 20 F (adj) above setpoint, the next boiler in the sequencer shall stage off.

f. All of the boilers shall rotate upon one of the following conditions: (user selectable):

1) manually through a software switch
2) if boiler runtime (adj.) is exceeded
3) daily
4) weekly
5) monthly

g. Alarms shall be provided as follows:

1) Boilers

a) Failure: Commanded on, but the status is off.
b) Running in Hand: Commanded off, but the status is on.
c) Runtime Exceeded: Status runtime exceeds a user definable limit.

h. Secondary Hot Water Supply Temperature Setpoint:
The secondary hot water temperature setpoint shall reset based on outside air temperature.

i. As outside air temperature rises from 0°F (adj.) to 70°F (adj.) the hot water supply temperature setpoint shall reset downwards from 180°F (adj.) to 110°F (adj.).

1) Alarms shall be provided as follows:

a) High Secondary Hot Water Supply Temp: If greater than 200°F (adj.).
b) Low Secondary Hot Water Supply Temp: If less than 100°F (adj.).

11. Hot Water Reset Valve:
The controller shall measure the secondary hot water supply temperature and modulate the mixing valve to maintain its setpoint as reset by the following Outside Air Temperature schedule (Adj.).

OA-T	HWS-T
0 F	180 F
60 F	120 F

a. The mixing valve shall be enabled whenever the hot water system is called to run.
b. The mixing valve shall close whenever the hot water supply temperature rises above 190°F (adj.).

12. Primary Hot Water Temperature Monitoring:
The following temperatures shall be monitored:

a. Primary hot water supply.

b. Primary hot water return.

c. Alarms shall be provided as follows:

1) High Primary Hot Water Supply Temp: If greater than 200°F (adj.).
2) Low Primary Hot Water Supply Temp: If less than 100°F (adj.).

13. Boiler Hot Water Temperatures Monitoring:
The following temperatures shall be monitored:

a. Boiler hot water supply.

b. Boiler hot water return.

c. Alarms shall be provided as follows:

1) High Hot Water Supply Temp: If greater than 200°F (adj.).
2) Low Hot Water Supply Temp: If less than 100°F (adj.).

B. EMERGENCY SHUTDOWN SWITCHES (Boilers B-1,2 & B-E & all Water Heaters

1. A remote mushroom type, single acting, manually reset, shutdown switch shall be located just inside the boiler room door and marked for easy identification. A pilot light shall illuminate whenever the push button is pressed. If there is more than one door to the boiler room, there should be a switch located at each door.

2. The emergency shutdown switch (es) when activated must disconnect all power to the boiler burner controls. A visual alarm indicator of a different color than the building fire alarm indicators shall be activated when the boilers are shutdown.
3. All natural gas supplied to each of these areas shall be shut off and the ventilation fan enabled when any of the remote mushroom type, single acting, manually reset, shutdown switches (one at each entrance) is activated. A separate push button and gas valve shall be located in each area. A pilot light shall illuminate whenever any push button is pressed. The push button(s) shall be well labeled. A line size U.L. listed, AGA approved control valve of the normally closed type shall be provided by the ATC contractor. The DDC system will monitor switch position and alarm upon activation.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Hot Water Differential Pressure	x								x		x
Secondary Hot Water Return Temp	x								x		x
Boiler Room Temp	X								X		x
Secondary Hot Water Supply Temp	x								x		x
Primary Hot Water Return Temp	x								x		x
Primary Hot Water Supply Temp	x								x		x
Boiler HW Return Temp (Each)	x								x		x
Boiler HW Supply Temp (Each)	x								x		x
Hot Water Pump x.x VFD Speed		x							x		x
Mixing Valve		x							x		x
Combustion Air Dmpr STS (Each)			X								x
Boiler Emergency Switch			X								x
Hot Water Pump x.x VFD Fault			x							x	x
Hot Water Pump x.x Status			x						x		x
Circulation Pump Status (Each)			x						x		x
Emergency Shutdown Switch			X							X	X
Isolation Valve Status			X						X		x
Boiler Room Vent Fan Status			X						X		x
Boiler Status (Each)			x						x		x
Hot Water Pump 1 Start/Stop				x							x
Hot Water Pump 2 Start/Stop				x							x
Circulation Pump Start/Stop (Each)						x			x		x
Combustion Air Dmpr				X							x
Boiler Isolation Valve (Each)				x					x		x
Boiler Enable (Each)				x							x

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Boiler Room Vent Fan Enable				X					x		x
Vent Fan Damper				X					X	x	x
Outside Air Temp	x								x		x
Outside Air Humidity	X								x		x
Hot Water Differential Pressure Setpoint					x				x		x
Secondary Hot Water Supply Temp Setpoint					x				x		x
High Hot Water Differential Pressure										x	
Low Hot Water Differential Pressure										x	
Hot Water Pump 1 Failure										x	
Hot Water Pump 1 Running in Hand										x	
Hot Water Pump 1 Runtime Exceeded										x	
Hot Water Pump 2 Failure										x	
Hot Water Pump 2 Running in Hand										x	
Hot Water Pump 2 Runtime Exceeded										x	
Circulation Pump Failure (Each)										x	
Circulation Pump Running in Hand (Each)										x	
Circulation Pump Runtime Exceeded (Each)										x	
Boiler Failure (Each)										x	
Boiler Running in Hand (Each)										x	
Boiler Runtime Exceeded (Each)										x	
Lead Boiler Failure										x	x
Low Secondary Hot Water Supply Temp										x	
High Secondary Hot Water Supply Temp										x	
High Primary Hot Water Supply Temp										x	
Low Primary Hot Water Supply Temp										x	

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Boiler High HW Supply Temp (Each)										x	
Boiler Low HW Supply Temp (Each)										x	

C. Boiler Interface

1. Boiler Interface Monitor:
   Current boiler status and operating conditions will be monitored through its communications interface port. The interface at a minimum will monitor and trend the points as shown on the Points List. Additional points will be available through the interface, coordinate with DCSD for required points shown on graphics, alarmed, trended, etc.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Burner Cycles					x						x
Operating Hours					x						x
Operating Pressure					x				x		x
Operating Temp					x				x		x
Hot Water Supply Temp Setpoint					x				x		x
Hot Water Supply Temp					x				x		x
Hot Water Return Temp					x				x		x
Boiler Status						x			x		x
Hot Water Flow Status						x			x		x

7.20 SNOW MELT SYSTEM

1. Snow Melt System Run Conditions:
   The snow melt system shall be enabled to run whenever:

   a. There is a call for snow melt from the Tekmar system.
   b. AND outside air temperature is less than 36°F (adj.).

2. The snow melt system will be provided by the mechanical contractor and installed by this contractor. See plans for senor and panel requirements.

   a. The Tekmar control panel will enable the boiler and associated pumps as required for snow melt control.
   b. If the Tekmar panel has BACnet integration capabilities, the contractor will integrate the system into the BAS.

3. Snow Melt Pump Operation:
   The snow melt pumps shall be controlled by the Tekmar control panel.

4. Secondary Monitoring:
   Provide monitoring and alarming of the snow melt supply and return temperatures.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Snow Melt Return Temp	x								x	x	x
Snow Melt Supply Temp	x								x	x	x
Tekmar Controls					x	x			x	x	x
Low Snow Melt Supply Temp										x	
High Snow Melt Supply Temp										x	

B. Variable Frequency Drive Interface

1. Variable Frequency Drive (VFD) Interface Monitor:
   Current VFD status and operating conditions shall be monitored through its communications interface port. The interface shall monitor and trend the points as shown on the Points List.

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Motor Speed RPM					x				x		x
Motor Frequency Hertz					x				x		x
Motor Current Amps					x				x		x
Motor Runtime					x						x
VFD Status						x			x		x
In Fault Condition						x			x	x	x
In Bypass						x			x	x	x

7.21 WSHP LOOP WATER SYSTEM - TEMPORARY

A. General:
   The existing ground source water system will be renovated during the first phase of construction. The loop field will be abandoned and replaced with the hot and chilled water systems as described above that will supply tempered water to a heat exchanger as well as the new portion of the building.
   This contractor is responsible to furnish and install DDC controls to control these temporary water systems that serve the water source heat pumps until they are replaced in the future.

B. Loop System Run Conditions:
The WSHP loop system shall be enabled to run during the occupied mode a definable number of unoccupied zones need heating or cooling.

1. Once enabled, the heat exchanger control valve will modulate to maintain supply water temperature setpoint of between 70Deg F and 85Deg F as reset by the outside air temperature.

C. The following loop water conditions shall be monitored:

1. Pump Status

2. Supply Temperature

3. Return Temperature

D. Alarms and a heat pump shutdown signal shall be generated upon any of the following loop water conditions:

1. No Loop Flow

2. High Loop Water Supply Temp Shutdown: If the loop water supply temperature is greater than 92 Deg F (Adj.).

3. Low Loop Water Supply Temp Shutdown: If the loop water supply temperature is less than 58 Deg F (Adj.).

E. Loop Water Pump Lead/Standby Operation:
The two loop water pumps shall operate in a lead/standby fashion

1. The lead pump shall run first and run continuously throughout the occupied day.
2. On failure of the lead pump, the standby pump shall run and the lead pump shall turn off.

3. The active loop pump will modulate to maintain loop differential pressure setpoint.

4. The designated lead pump shall rotate upon one of the following conditions (user selectable):

    a. Manually
    b. If Pump runtime is exceeded
    c. Daily, Weekly, Monthly

F. Pump alarms shall be provided as follow:

1. Failure: Commanded on, but the status is off.
2. Running in Hand: Commanded off, but the status is on.
3. Runtime Exceeded: Status runtime exceeds a user definable limit

G. Heating/Cooling:

1. The 3-way heat exchanger isolation valve will select between heating and cooling as required by the WHSP supply water loop temperature.

    a. If heating is required (loop temperature below 70 Deg F (Adj.) for 20 minutes) the isolation valve will open to the boiler and the hot water system shall operate as described above.

1) The heat exchanger control valve will modulate to maintain WSHP supply water temperature of 75 Deg F (Adj).

b. If cooling is required (loop temperature above 85 Deg F (Adj.) for 20 minutes) the isolation valve will close to the boiler and the open to the chiller and the chilled water system shall operate as described above.

1) The heat exchanger control valve will modulate to maintain WSHP loop supply water temperature of 75 Deg F

2) The chiller will cycle under its own controls to maintain primary loop supply water temperature.

PART 8 – ALARMS

8.1 ALARMS

A. **DOMESTIC WATER FLOW SECURITY SENSOR**

1. A paddle type, water flow sensor located in the smaller of the two lines in the main domestic water line and upstream from the pressure reducing valve, shall through the DDC system, signal the Host computer any time flow is sensed during the UNOCCUPIED mode. Division 25 contractor shall run line to building security dam for tie into building security system. The paddle shall be a Potter Model VSG (3-GPM) and shall be furnished and wired by the ATC contractor and installed by the plumbing contractor. ATC contractor to coordinate size required. Provide status contact closure to the security system. Coordinate line to security panel with Division 26.

B. **FREEZER, COOLER AND COLD STORAGE TEMPERATURE ALARMS**

1. Provide an analog DDC temperature sensor for each freezer and cold storage area. An alarm to the District remote security facility through the Lan Network shall be generated whenever temperatures **drop below or above** the owner determined limits via a status contact closure to the security system. System must be configured to follow the alarm requirements defined within this specification.

C. **MDF/IDF/ELECTRICAL ROOM ALARM**

1. An alarm to the District remote security facility through the Lan Network shall be generated whenever temperatures **drop below or above** the owner determined limits via a status contact closure to the security system. System must be configured to follow the alarm requirements defined within this specification.
2. Areas served with AC-1 cooling unit and supplementary cooling only VAV box and sensor shall utilize the AC unit as main control. Upon receiving a high temperature alarm the secondary cooling only VAV box shall open with associated return air motorized damper to provide ventilation to space until overridden thru DDC control.

D. **BUILDING LOW TEMPERATURE ALARM**

1. A low temperature alarm shall be c capable of being generated for any zone of the building.
2. Low temperature alarm shall be provided at all fire riser rooms and locations.
3. An alarm to the District remote security facility through the Lan Network shall be generated whenever temperatures **drop below or above** the owner determined limits via a status contact closure to the security system. System must be configured to follow the alarm requirements defined within this specification.

E. **FAN SYSTEM FILTER BANK ALARMS**

1. A differential pressure indication control element with its static pressure tips located across each fan system filter bank & makeup air unit filter bank shall provide the DDC system with the differential pressure drop across each filter bank. An alarm shall be supplied to the DDC system whenever the filter differential pressure remains above 0.35" w.c. for more than 15 continuous minutes.

END OF SECTION 25 1000

DIVISION 26 - ELECTRICAL

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26 22 00	LOW-VOLTAGE TRANSFORMERS
26 24 13	SWITCHBOARDS
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26 28 18	ENCLOSED SWITCHES
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26 43 00	SURGE PROTECTIVE DEVICES
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SECTION 260500 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide labor, materials, and equipment necessary for completion of work of this Division as described in Contract Documents.

1.2 RELATED SECTIONS

A. General Conditions and Division 01 apply to this Section

1.3 SUBMITTALS

A. As-Built Drawings
   1. Provide complete set with all changes made to original drawings. Provide CADD files. Hand-drawn changes are not acceptable.

B. Product Data
   1. Submit for the following:
      a. Wiring devices
      b. Disconnects
      c. Panelboards
      d. Motor Starters
      e. Lighting fixtures, poles, and associated control equipment
      f. Fire alarm & detection equipment
      g. Intercom communications equipment
      h. Voice & data cabling & termination equipment
      i. Security and surveillance equipment
      j. Standby Emergency Generator Set
      k. Sound system equipment
      l. Low-voltage transformers
   2. Provide the following information for each item of equipment:
      a. Catalog sheets
      b. Assembly details of dimension drawings
      c. Installation instructions
      d. Manufacturer's name and catalog number
      e. Name of local supplier
      f. Name of electrical contractor

C. Operation & Maintenance Manual
   1. Provide two copies of Operation and Maintenance Manuals.
      a. Binder - Loose-leaf type with hard cover. Title on outside of front cover and on spine.
      b. Title Page - List the following information
         1) Name of Project
         2) Date Project Completed
         3) Name and Address of Architect, Electrical Engineer, General Contractor, Electrical Contractor, and Suppliers.
      c. Table of Contents -
         1) List equipment in order that it appears in Binder.
      d. Dividers -
         1) Provide one divider with tab for each type of equipment listed in Table of Contents. Properly label tabs.
      e. Equipment Information - Provide following information for each item of equipment:
         1) Catalog Sheets.
         2) Assembly details or dimension drawings.
         3) Installation, operating, and maintenance instructions.

4) Manufacturer's name and catalog number
5) Name of local supplier.

f. Furnish such information for following equipment and arrange as listed -
1) Disconnect switches.
2) Wiring devices.
3) Lighting fixtures.
4) Panelboards
5) Fire alarm and detection system
6) Standby generator set
7) Communications systems equipment
8) Security and surveillance system
9) Low-voltage transformers

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Furnish UL listed equipment where such label is available. Install in conformance with UL standards where applicable.

B. Install electrical work in accordance with Drawings and Specifications, edition of NEC in effect at project location, recommendations of NFPA, state and local electrical and building codes, and special codes having jurisdiction over specific portions of work. This includes, but is not limited to the latest adopted version of the following
1. National Electrical Code with applicable local amendments
2. International Fire Code with applicable state or local amendments
3. Life Safety Code, NFPA 101
4. International Building Code
5. International Energy Conservation Code
6. In the event of conflict between Drawings, Specifications and such codes, notify Architect in writing prior to bid. A ruling will then be made by Architect in writing.
7. Obtain permits and certificates of approval from all authorities having jurisdiction over the installation and pay all fees required for scope of work being done including connection fees, impact fees, power company installation costs, etc.

1.5 WARRANTY

A. Guarantee work to be free from defects of materials and workmanship for a period of one year from date of final acceptance of building by authorities having jurisdiction.

B. Furnish owner with three written copies of Guarantee-Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Substitutions:
1. Where Manufacturer's names appear, other Manufacturers may be substituted upon obtaining written approval of Architect at least 10 days prior to opening of bids
2. Any prior approval of alternate equipment does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.
3. If submittals of alternate equipment require more than two reviews by the engineer, a fee of $250 will be charged to the contractor and payable to the engineer before submittals will be approved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections. Coordinate electrical equipment locations with other trades to maintain required working clearances and prevent encroachment into such working spaces.

B. Confirm and verify electrical power specifications (i.e., voltage, phase, amperage, etc.) and electrical equipment and material requirements for all HVAC equipment, water heaters, water coolers, appliances, pumps, and other powered equipment provided by others, before beginning rough-in. All coordination shall be done with approved shop drawings or submittals.

3.2 INSTALLATION

A. Electrical drawings are diagrammatic. Do not scale for exact sizes or locations. Drawings are not intended to disclose absolute or unconditional knowledge of actual field conditions. Some equipment may need to be relocated from the locations indicated on the drawings to maintain working spaces around equipment. Any such coordination and relocation shall be the responsibility of the electrical contractor.

B. Be prepared to relocate any outlet or device 6 feet in any direction without additional charge to the owner prior to wall, ceiling, or floor finish materials being installed.

C. Install equipment according to manufacturer's recommendations.

D. In the event of conflict between specifications and drawings, or between various areas on drawings or specifications, notify Engineer in writing in sufficient time prior to bid to prepare the supplementary drawings and specification addenda required to resolve the conflict. In the event of a conflict, the most stringent requirement shall govern.

E. Provide electrical equipment and materials for, and make all connections to equipment furnished by others, including but not limited to items such as kitchen equipment, building and pole-mounted signs, shop equipment, etc. as required for a complete and operable system.

F. Provide protective wire cages or covers on equipment located in areas where damage to the unit could occur such as gymnasiums, multi-purpose rooms, etc. Such equipment shall include, but not be limited to clocks, emergency lighting units, exit signs, etc.

3.3 FIELD QUALITY CONTROL

A. Test systems and demonstrate equipment as working and operating properly. Rectify defects at no additional cost to Owner.

B. All work under this division shall be executed in a thorough workmanlike manner, as determined by the Engineer, by competent and experienced journeyman electricians.

C. All work shall be installed in strict conformance with all manufacturers' requirements and recommendations.

3.4 FIRE STOPPING AND SEALING

A. Seal around conduits or other wiring materials passing through fire rated walls in accordance with Architectural details and/or specifications using U.L. listed fire caulk.

3.5 TEMPORARY LIGHTING AND POWER

A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades including any 3-phase power required.

B. Provide and maintain barricade lighting where required to adequately protect owner against liability for damage to public or personnel.

3.6 CUTTING AND PATCHING

A. Cut all openings required to install the work of this Division or to repair any defective work. Cost for all cutting and patching required by the work of this Division shall be included, however, the actual cutting and patching shall be under the Prime Contractor's direction. Exercise due diligence to avoid cutting openings larger than required or openings that are in the wrong locations.

B. It is the intent to minimize the amount of exposed conduit on the roof and penetrations through the roof. Install conduit below roof and up through the inside of the equipment where possible. In the event roof penetrations must be made, the conduit shall be installed through waterproof sheetmetal housings or water proof pitch pans as detailed on the drawings.

3.7 IDENTIFICATION

A. Provide for each dimmer, panelboard, terminal cabinet, motor starter, motor controller, pushbutton, control switch, time clock, etc., furnished and/or installed under this Division of the Specifications, with identification as to its designation or specific function.
   1. Identification shall be a laminated, white core, black plastic nameplate with beveled edges.
   2. Lettering shall be machine-engraved, not less than 3/16 in. high, cut through the black surface to the white core.
   3. Secure nameplate to the identified item by the use of stainless steel self-tapping screws.
   4. Impressed plastic shall not be used to satisfy this requirement.
   5. Panel schedules shall be typed.

3.8 FIRE SAFETY EQUIPMENT

A. Provide electrical circuit for, and make connections to fire sprinkler system bell.

3.9 GUARANTEE-WARRANTY:

A. Guarantee work to be free from defects of materials and workmanship for a period of one year from date of final acceptance of building by authorities having jurisdiction.

B. Furnish owner with three written copies of Guarantee-Warranty.

3.10 OBSERVATIONS:

A. All work of this division shall be observed periodically by the Engineer. The contractor shall notify the engineer minimum one week prior to the requested observation date. At a minimum, inspections shall be performed upon completion of the following phases of construction:
   1. Completion of underground conduit rough-in, prior to concrete floor installation.
   2. Completion of above-grade conduit rough-in, prior to installation of wall material (gypboard).
   3. Substantial completion of entire electrical system.

B. Failure to notify the engineer at the indicated times during construction may result in removal of concrete, wall board or other materials to allow a complete inspection.

C. At the request of the Engineer, the contractor shall remove panel covers, fixture lenses, ballast covers, wall plates, wiring devices, and any other items as required to allow a complete inspection and determination of compliance with the contract documents.

END OF SECTION

SECTION 260505 - SELECTIVE DEMOLITION FOR ELECTRICAL

GENERAL - PART I

1.1 Related Documents:

A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2A Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to demolition.

1.2 Description of Work:

A. All relocations, reconnections and removals are not necessarily indicated on Drawings. All such required work shall be included without additional cost to Owner. Other demolition work shall be performed as required to maintain system operation.

B. The intent of the drawings is not to show every device, outlet, fixture, conduit, etc. affected by demolition work.

C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.

D. Refer to sections of other Divisions for applicable requirements affecting demolition work.

1.3 Quality Assurance:

A. NEC Compliance: Comply with applicable portions of NEC as to methods used for demolition work.

EXECUTION - PART III

3.1 General:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

3.2 Patching and Repair:

A. The contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.

B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc.

C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

3.3 Existing Equipment:

A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.

B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.

C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.

D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.

E. When installing equipment in the existing building, it shall be concealed.

F. Existing raceways shall be used where possible, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be carefully removed, and turned over to the Owner. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, re-lamped and installed as indicated.

G. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

END OF SECTION

SECTION 260519 - POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wire and cable for 600 volts and less.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Oxide inhibiting compound.

H. Wire pulling lubricant.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

B. Section 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2001 (Reapproved 2007).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007.

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2008.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; National Electrical Contractors Association; 2006 (NECA/AA 104).

K. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association; 2006.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).

M. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

N. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 83 - Thermoplastic-Insulated Wires and Cables; 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.

1.4 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 the contract documents. Obtain direction before proceeding with work.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, 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

2.1 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. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used in indoor dry locations where it is:
      a. May be used in indoor dry locations where it is -
         1) Not subject to damage.
         2) Concealed in walls.
         3) Not in contact with earth.
         4) Not in concrete.
      b. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet.

2.2 ALL CONDUCTORS AND CABLES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

I. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
   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.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. 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 6 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. Equipment Ground, All Systems: Green.
   d. Travelers for 3-Way and 4-Way Switching: Pink.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.4 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, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

G. Description: NFPA 70, Type MC.

H. Conductor: Copper.

2.5 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 0526.

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. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com.
      b. Ideal Industries, Inc: www.idealindustries.com.
      c. NSI Industries LLC: www.nsiindustries.com.

G. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com.
      c. Thomas & Betts Corporation: www.tnb.com.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com.
      c. Thomas & Betts Corporation: www.tnb.com.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.6 WIRING 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; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

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.
1. Manufacturers:
a. Burndy: www.burndy.com.
b. Ideal Industries, Inc: www.idealindustries.com.
c. Ilsco: www.ilsco.com.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
1. Manufacturers:
a. 3M: www.3m.com.
b. American Polywater Corporation: www.polywater.com.
c. Ideal Industries, Inc: www.idealindustries.com.

PART 3 - EXECUTION

3.1 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 shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated and routing is not shown, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location shown.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
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.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

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 12 inches of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. 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.
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.

M. 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.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. 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.

P. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

R. 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.

S. Conductors shall be continuous from outlet to outlet.

T. Protect exposed cable from damage.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 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.

F. Ground access wells.

G. Grounding and bonding components.

H. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Metal underground water pipe.
   2. Metal frame of the building.
   3. Concrete-encased electrode.
   4. Rod electrodes.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 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 the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 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 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

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 at an accessible location not more than 5 feet 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 Building or Structure Frame:
   a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of steel reinforcing bars 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 from each other and any other ground electrode.

c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
d. Provide ground access well for each electrode.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

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. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
a. Transformers (except autotransformers such as buck-boost transformers).
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

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. Raceways may be used as sole equipment grounding conductor where permitted by NFPA 70. Provide insulated equipment grounding conductor where indicated or required, including but not limited to:
a. In each nonmetallic feeder and branch circuit raceway.
b. In each flexible conduit.
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 (fire sprinkler & culinary) where not already effectively bonded to metal underground water pipe used as grounding electrode.
b. Metal gas piping.

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: 6 AWG, unless otherwise indicated or required.
      b. Raceway Size: 3/4 inch unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

   1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

   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 0519:
   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 or compression connectors for underground, concealed and other inaccessible connections.
      a. Exceptions:
         1) Use mechanical connectors for connections to electrodes at ground access wells.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
      a. Exceptions:
         1) Use exothermic welded connections for connections to metal building frame.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Burndy: www.burndy.com.
      b. Harger Lightning & Grounding: www.harger.com.
      c. Thomas & Betts Corporation: www.tnb.com.
   5. Manufacturers - Exothermic Welded Connections:
      a. Burndy: www.burndy.com.
      b. Cadweld, a brand of Erico International Corporation: www.erico.com.
      c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.

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.
   4. Manufacturers:
      a. Erico International Corporation: www.erico.com.
      b. Harger Lightning & Grounding: www.harger.com.
      c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
   4. Manufacturers:
      a. Erico International Corporation: www.erico.com.
      b. Galvan Industries, Inc: www.galvanelectrical.com.
      c. Harger Lightning & Grounding: www.harger.com.

F. Ground Access Wells:
   1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
   2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
      a. Round Wells: Not less than 8 inches in diameter.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
   4. Cover: Factory-identified by permanent means with word "GROUND".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

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.

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 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.

C. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.

D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

F. Conduit and equipment supports.

G. Anchors and fasteners.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2011.

D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components 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. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the 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 3000.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 - PRODUCTS

2.1 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 electrical work.
   2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated, 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. Include consideration for vibration, equipment operation, and shock loads 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 the 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. Conduit and Cable Supports: Straps, clamps, etc. suitable for the 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.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the 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. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: 12 gauge.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

2.2 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized or painted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner 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. 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. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 0534.

I. Box Support and Attachment: Also comply with Section 26 0537.

J. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.

K. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
   1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
   2. Obtain permission from Architect before drilling or cutting structural members.

E. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

G. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 260534 - CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquid-tite flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Electrical nonmetallic tubing (ENT).

H. Conduit fittings.

I. Accessories.

J. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 8400 - Firestopping.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0537 - Boxes.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2701 - Electrical Service Entrance: Additional requirements for electrical service conduits.

H. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems conduits.

I. Section 31 2316 - Excavation.

J. Section 31 2323 - Fill: Bedding and backfilling.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.

J. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); National Electrical Manufacturers Association; 2005.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

P. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

R. UL 886 - Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

T. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a 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. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or intermediate metal conduit (IMC) where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection.
   7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
   2. Within Concrete Walls Above Ground: Use intermediate metal conduit (IMC) or rigid PVC conduit.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or intermediate metal conduit (IMC) where emerging from concrete.

E. Concealed within Masonry Walls: Use electrical metallic tubing (EMT) or rigid PVC.

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT) or electrical nonmetallic tubing (ENT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use 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, except within electrical and communication rooms or closets.

K. Exposed, Exterior: Use intermediate metal conduit (IMC).

L. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.
   1. Corrosive locations include, but are not limited to:
      a. Cooling towers.

M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

O. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 2701.

B. Communications Systems Conduits: Also comply with Section 27 1005.

C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 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.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 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. Non-Hazardous Locations: Use 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 threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 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. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   3. Material: Use steel or malleable iron.

4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 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 to be used.

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.

C. Description: Interlocked steel construction.

D. Fittings: NEMA FB 1.

2.6 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.

C. Description: Interlocked steel construction with PVC jacket.

D. Fittings: NEMA FB 1.

2.7 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT 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.
   4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.8 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.

2.9 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 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.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the 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 cord with average breaking strength of not less than 200 pound-force.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

G. Run a minimum of one 3/4 inch spare conduit for every three single pole spare circuit breakers or spaces, but not less than three conduits from each new panel to ceiling access area above and below (if applicable) panel and cap so no foreign matter will enter conduit while not in use.

H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all 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 conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all 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 the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet 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 between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches 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 the same area together on a common rack.

I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
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 non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of wire for support of conduits is permitted only as follows:
   a. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).

J. Connections and Terminations:
1. Use approved 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 liquid-tite 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 rain-tight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.

7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. 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. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. 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. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install fire-stopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

L. Underground Installation:
1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
4. Provide long-sweep elbows for telephone and power service entrance conduits.

M. Embedment within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. 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 conduits are subject to earth movement by settlement or frost.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 26 0526.

3.3 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.4 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.

3.5 PROHIBITED PROCEDURES

A. Use of wooden plugs inserted in concrete or masonry units as base for fastening conduits, tubing, boxes, cabinets, or other equipment.

B. Torches for bending PVC conduit.

C. Installation of conduit or tubing which has been crushed or deformed.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

B. Route conduit through roof openings for piping and ductwork wherever possible.

END OF SECTION

SECTION 260535 - SURFACE RACEWAYS – ONLY USED WITH SPECIAL PERMISSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface raceway systems.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0534 - Conduit.

D. Section 26 0537 - Boxes.

E. Section 26 2726 - Wiring Devices: Receptacles.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 111 - Outline of Investigation for Multi-outlet Assemblies; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 26 0537 and conduit provided under Section 26 0534 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
   1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.2 SURFACE RACEWAY WITH DEVICES

A. Two channel with locking hinge cover.
   1. Maximum dimensions of 5 1/4" x 1 11/16"
   2. Wall thickness: 0.06" minimum
   3. Voltage rating: 300VAC
   4. U.V. Stabilized PVC

B. Design Standard: (Wiremold)
   1. 5400 raceway
   2. 5450 device bracket
   3. 5507D duplex face plate with duplex receptacle

C. Used only upon permission from, and at the discretion of, the Owner and Architect.

2.3 SURFACE RACEWAY

A. Single channel with locking hinge cover.
   1. Maximum dimensions of 1.23" x .50"
   2. Wall thickness: .06" minimum.
   3. Voltage rating: 300V AC
   4. U.V. Stabilized PVC
   5. Design Standard: Hubbell WallTrak 1

B. Used only upon permission from, and at the discretion of, the Owner and Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install raceways in a neat and workmanlike manner in accordance with NECA 1.

C. Install raceways plumb and level.

D. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.

E. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 26 0526.

3.2 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.3 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 0536 CABLE TRAY

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this section consists of the furnishing of all necessary materials, labor, supervision, equipment and services to install complete wire basket cable tray system as shown on the drawings.

B. Wire basket cable tray is defined to include, but are not limited to straight sections of continuous wire mesh, splices, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.
B. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
C. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
D. ASTM A 123 – Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel
E. ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
F. NEMA VE 1-2002 – Metal Cable Tray Systems
G. NEMA VE 2-2006 – Cable Tray Installation Guidelines
H. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
I. ASTM A 580 – Standard Specification for Stainless Steel Wire
J. ASTM D 769 – Standard Specification for Black Oxide Coatings
K. Section 26 05 13 – Medium-Voltage Cables.
L. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
M. Section 26 05 23 – Control-Voltage Electrical Power Cables.
N. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
O. Section 27 11 23 – Communication Cable Management & Ladder Racks.
P. Section 28 05 13 – Conductors and Cables for Electronic Safety and Security.
Q. TIA 569-A – Commercial Building Standard for Telecommunications Pathways & Spaces
R. NFPA 70 (2005) – National Electrical Code (NEC)
S. CSA C22.2 No. 126. 1-02 – Metal Cable Tray Systems
T. IEC 61537 (2001) – Cable Tray Systems and Cable Ladder Systems for Cable Management
U. TIA -942 Data Center Standard

1.3 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the wire basket cable tray system. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.
B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.4 SUBMITTALS

A. Submittal Drawings: Submit Product data and drawings of wire basket cable tray and accessories including straight sections, splice hardware, mounting accessories showing accurately scaled components. Drawings to verify UL / C-UL classifications
B. Product Data: Submit manufacturer’s data on wire tray sections and support system including, but not limited to, types, materials, finishes, loading information, fill rates and product dimensions.

1.5 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).
B. NFPA Compliance Comply with NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to installation of cable tray systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver wire tray sections and accessories carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.
B. Store wire basket and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer:
   1. WBT.
   2. Approved equal.

2.2 WIRE TRAY SECTIONS AND COMPONENTS

A. General: Provide wire basket of types and sizes indicated; with all required splicing and mounting hardware. Construct units with T-weld edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
B. Materials and Finishes: Material and finish specifications for Carbon Steel Wire, Pre-Galvanized Steel Wire and Stainless Steel Wire are as follows:
   1. Pre-Galvanized Zinc: Straight section shall be made from pre-galvanized steel meeting the minimum mechanical properties of ASTM A 641. Material must be cleaned after fabrication to remove any soot, manufacturing residue/oils, or metallic particles

2.3 TYPE OF WIRE BASKET SUPPORT SYSTEM

A. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be T-welded on all tray sizes.
B. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
C. Wire basket sizes shall conform to the following nominal criteria:
   1. Straight sections shall be furnished in standard 142 inch lengths.
   2. Wire diameter shall be 0.195” (5mm) minimum on all mesh sections up to 16 linear inches. Wire diameter linewire shall be 0.234” (6mm) minimum on all mesh sections in excess of 16 linear inches. Wire diameter shall be minimum size of 4.5mm on stainless steel.
   3. Wire basket shall have a 6 inch usable loading depth by 18 inches wide.
D. All fittings shall be field formed, from straight sections, in accordance with manufacturer’s instructions.
E. All Tray sections and splicing assemblies shall be UL/C-UL Classified as an Equipment Ground Conductor (EGC).
   1. Center Support - WBT CENTER SUPT 18
      a. Installs with Single threaded rod to allow loading from both sides of the tray. Built in tabs secure tray to hardware. Accepts up to ½” threaded rod
   2. Ceiling Support - WBT CEILING SUPT 18
      a. Provides a full bottom support of tray. Installs with 2 threaded rod.
   3. Trapeze Support - WBT TRAP SUPT 18
      a. Supports both sides of tray from the vertical edges.
   4. Wall/Shelf Support - WBT SHELF SUPT 18
      a. Most secure wall mount of tray up to 24” width

5. L bracket - WBT LBRACKET SUPT 18
6. C bracket - WBT CBRACKET SUPT 18
   a. Attaches tray to vertical/wall surface
7. Splice Kit – SPLICE KIT
   a. Splices straight sections and fittings
8. Bar Splice – BAR SPLICE
   a. Splices straight sections and fittings
9. Corner Splice – CORNER SPLICE
   a. Used to Splice tray intersections and corner

F. Product Key: WBT(depth) x (width) x (length)(finish).
G. Special accessories shall be furnished as required to protect, support and install a wire basket support system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wire basket as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
B. Coordinate wire basket with other electrical work as necessary to properly interface installation of wire basket runway with other work.
C. Provide sufficient space encompassing wire basket to permit access for installing and maintaining cables.

3.2 TESTING

A. Test wire basket support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

END OF SECTION

SECTION 26 0537 J-HOOK SUPPORTS

PART 1 - GENERAL

1.1 Scope

A. Non-continuous cable supports.

B. Non-continuous cable support assemblies from drop wire/ceiling.

C. Non-continuous cable support assemblies from beam, flange.

D. Non-continuous cable support assemblies from C & Z Purlin.

E. Non-continuous cable support assemblies from wall, concrete, or joist.

F. Non-continuous cable support assemblies from threaded rod.

1.2 Summary

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports as described in this specification.

1.3 Definitions

A. UTP: Unshielded twisted pair.

B. ANSI: American National Standards Institute.

C. ASTM: American Society for Testing and Materials.

D. EIA: Electronic Industries Alliance.

E. TIA: Telecommunications Industry Association.

1.4 Submittals

A. Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes approvals, load ratings, and dimensional information.

1.5 Acceptable Manufacturers

A. Subject to compliance with these specifications, non-continuous cable supports shall be as manufactured by Cable Management Solutions, Inc or approved equal.

1.6 References

A. ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel.

B. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled.

E. A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process.

F. ANSI/ TIA/ EIA 568 Commercial Building Telecommunications Cabling Standard, current revision level.

G. ANSI/ TIA/ EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.

H. NFPA 70 National Electrical Code®.

PART 2 - PRODUCTS

2.1 Non-continuous Cable Supports

A. Non-continuous cable supports shall provide a bearing surface that will allow for cable sag and will not allow the cables to form a compound bend radius sufficient to form a non-compliant bend radius.

B. Non-continuous cable supports shall have smooth edges to prevent damage while installing cables.

C. Non-continuous cable supports shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

D. Non-continuous cable supports shall have an electro-galvanized finish and shall be rated for indoor use in non-corrosive environments.

E. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.2 Multi-tiered Non-continuous Cable Support Assemblies

A. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments.

B. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.3 Non-continuous Cable Support Assemblies from Drop Wire/ceiling

A. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.

B. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.4 Non-continuous Cable Support Assemblies from Beam, Flange

A. Fastener to beam or flange with one non-continuous cable support factory assembled; rated for indoor use in non-corrosive environments.

B. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.5 Non-continuous Cable Support Assemblies from C & Z Purlin

A. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.

B. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.6 Non-continuous Cable Support Assemblies from Wall, Concrete, or Joist

A. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.

B. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.7 Non-continuous Cable Support Assemblies from Threaded Rod

A. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments.

B. The multi-tiered support bracket shall have a static load limit of 300 lbs.

C. Non-continuous cable supports shall be Snake Tray Snake Hook ™ Cable hook series or approved equal.

2.8 Finishes

A. ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel.

B. ASTM B 695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel.

C. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

E. Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

PART 3 - EXECUTION

3.1 Installation

A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

B. Install cables using techniques, practices, and methods that are consistent with EIA/TIA recommendations or higher requirements and that supports completed and linked signal paths, end to end.

C. Install cables without damaging conductors, shield, or jacket.

D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

E. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

F. Do not exceed load ratings specified by manufacturer.

G. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

END OF SECTION

SECTION 26 0538 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0534 - Conduit:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Additional requirements for locating boxes for wiring devices.

H. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 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 by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.
   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, 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 suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. 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.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
   12. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use sheet-steel, cast iron, or nonmetallic floor boxes within slab above grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 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. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 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 2726.
   b. Communications Systems Outlets: Comply with Section 27 1005.
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 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 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 separation where wall is constructed with individual non-

communicating stud cavities.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet 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 0534.
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.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 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.

J. Install boxes plumb and level.

K. 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 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 at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify boxes in accordance with Section 26 0553.

T. Label all circuits and source panels on exterior of each junction box.

U. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

V. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

W. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

X. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.5 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260548 - SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
   1. AISC 325 (2005) Manual of Steel Construction

C. U.S. DEPARTMENT OF DEFENSE (DOD)
   1. UFC 3-310-04 (2007) Seismic Design for Buildings

D. UNDERWRITERS LABORATORIES (UL)
   1. UL 1598 (2008; Rev thru Feb 2009) Luminaires

1.2 SYSTEM DESCRIPTION

A. General Requirements
   1. The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below.

B. Electrical Equipment
   1. Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:
      a. Control Panels
      b. Switchgear
      c. Light Fixtures
      d. Motor Control Centers
      e. Transformers
      f. Switchboards (Floor Mounted)
      g. Panelboards

C. Electrical Systems
   1. The following electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:
      a. Transformers
      b. Panelboards
      c. Light Fixtures

D. Contractor Designed Bracing
   1. The Contractor shall design the bracing in accordance with UFC 3-310-04 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. UFC 3-310-04 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using UFC 3-310-04 are based on strength design; therefore, AISC 325 shall be used for the design. The bracing for the following electrical equipment and systems shall be developed by the Contractor: transformer and panelboards.

E. Conduits Requiring No Special Seismic Restraints

   1. Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.3 EQUIPMENT REQUIREMENTS

A. Rigidly Mounted Equipment
   1. The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in UFC 3-310-04. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.
      a. Transformers
      b. Panelboards
      c. Light Fixtures

1.4 SUBMITTALS

A. Submit the following:
   1. Shop Drawings
      a. Lighting Fixtures in Buildings
      b. Equipment Requirements
      c. Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.
   2. Product Data
      a. Lighting Fixtures in Buildings
      b. Equipment Requirements
      c. Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.
      d. Contractor Designed Bracing
      e. Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

A. Lighting fixtures and supports shall conform to UL 1598.

PART 3 - EXECUTION

3.1 SWAY BRACES FOR CONDUIT

A. Conduit shall be braced as for an equivalent weight pipe.

3.2 LIGHTING FIXTURES IN BUILDINGS

A. Lighting fixtures and supports shall conform to the following:
   1. Pendant Fixtures
      a. Pendant fixtures shall conform to the requirements of UFC 3-310-04.

2. Ceiling Attached Fixtures
    a. Recessed Fluorescent Fixtures
        1) Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system. Seismic protection for the fixtures shall conform to the requirements of UFC 3-310-04. Recessed lighting fixtures not over 56 pounds in weight may be supported by and attached directly to the ceiling system runners using screws or bolts, number and size as required by the seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.
    b. Surface-Mounted Fluorescent Fixtures
        1) Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Seismic protection for the fixtures shall conform to the requirements of UFC 3-310-04.
3. Assembly Mounted on Outlet Box
    a. A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 3 inch boxes, plaster rings, and fixture studs.

END OF SECTION

SECTION 260553 - ELECTRICAL SYSTEMS IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Underground warning tape.

D. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 27 1005 - Structured Cabling for Voice and Data: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2007.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2007.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 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.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.1 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. Panelboards:
    1) Identify power source and circuit number. Include location when not within sight of equipment.
    2) Identify main overcurrent protective device. Use identification nameplate for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
    3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
    4) For power panelboards without a door, use identification nameplate or identification label to identify load(s) served for each branch device. Do not identify spares and spaces.
b. Transformers:
    1) Identify voltage and phase for primary and secondary.
    2) Identify power source and circuit number. Include location when not within sight of equipment.
    3) Identify load(s) served. Include location when not within sight of equipment.
c. Enclosed switches, circuit breakers, and motor controllers:
    1) Identify voltage and phase.
    2) Identify power source and circuit number. Include location when not within sight of equipment.
    3) Identify load(s) served. Include location when not within sight of equipment.
d. Enclosed Contactors:
    1) Identify load(s) and associated circuits controlled. Include location.
e. Transfer Switches:
    1) Identify voltage and phase.
    2) Identify power source and circuit number for both normal power source and standby power source. Include location.
    3) Identify load(s) served. Include location.

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 equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for all electrical equipment such as switchboards, panelboards, safety disconnect switches, VFD's, etc.. Employ the services of a licensed electrical engineer to perform all Arc Flash calculations for each piece of equipment.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
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 underground warning tape to identify direct buried cables.

C. Identification for Boxes:
   1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

D. Identification for Devices:
   1. Identification for Communications Devices: Comply with Section 27 1005.
   2. Use identification label to identify fire alarm system devices.
   3. Use identification label to identify serving branch circuit for all receptacles.
      a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
   4. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

E. Identification for Luminaires:

   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 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; engraved text.
      a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch 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.
      a. Use only for indoor locations.
   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 by 2.5 inches.
   2. Legend:
      a. Equipment designation or other approved description.
      b. Other information as indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. Equipment Designation: 1/2 inch.
      b. Other Information: 1/4 inch.
      c. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
   5. Color:
      a. Normal Power System: White text on black background.
      b. Emergency Power System: White text on red background.

D. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

E. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Load controlled or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

F. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Designation indicated and device zone or address.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Red text on white background.

2.3 VOLTAGE MARKERS

A. Minimum Size:

B. Legend:

C. Color: Black text on orange background unless otherwise indicated.

2.4 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. 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.

2.5 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches 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.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

D. Description: 4 inch wide plastic tape, detectable type colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.2 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. Boxes: Outside face of cover.
8. Conductors and Cables: Legible from the point of access.
9. 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 or self-adhesive backing and to interior surfaces using self-adhesive backing, or epoxy cement.

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 below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

B. Install nameplates and labels parallel to equipment lines.

C. Secure nameplates to equipment front using screws or adhesive.

D. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION

SECTION 26 0573 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 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.

1.2 RELATED REQUIREMENTS

A. Section 26 0553 - Electrical Systems Identification: Additional requirements for arc flash hazard warning labels.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).

B. IEEE 141 - IEEE Recommended Practice for Electrical 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 1 - Motors and Generators 2018.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.

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 2021.

1.4 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 Architect 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 Architect.

1.5 SUBMITTALS

A. Study preparer's qualifications.

B. Study reports, stamped or sealed and signed by study preparer.

C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
1. Include characteristic time-current trip curves for protective devices.
2. Include impedance data for busway.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Identify modifications made in accordance with studies that:
a. Can be made at no additional cost to Owner.
b. As submitted will involve a change to the contract sum.

D. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

E. Site-specific arc flash hazard warning labels.

F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

G. Project Record Documents: Revise studies as required to reflect as-built conditions.
1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:
1. Perform analysis of new electrical distribution system as indicated on drawings.
2. 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).
3. 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.
2) Generator 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: As indicated on drawings.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
      d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      e. 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).
      f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
      g. 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.

      a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
      b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
   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) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
         6) Motors: Full load current, starting curves, and damage curves.
         7) Capacitors: Full load current and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
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.

1.7 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.
   1. Products:
      a. EasyPower LLC: www.easypower.com
      b. ETAP/Operation Technology, Inc: www.etap.com
      c. Power Analytics Corporation: www.poweranalytics.com
      d. SKM Systems Analysis, Inc: www.skm.com

PART 2 PRODUCTS

2.1 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 0553.
   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 orange header that reads "WARNING" unless otherwise indicated.
      b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
      c. 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) Study preparer, report reference, and date calculations were performed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Adjust equipment and protective devices for compliance with studies and recommended settings.

C. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

3.3 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
   1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
   2. Instructor: Representative of entity performing study.
   3. Location: At project site.

END OF SECTION

SECTION 260918 - REMOTE CONTROL SWITCHING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Networked switching controls.

B. Programmable switching controls.

C. Remote switches.

D. Power supplies.

E. Relay cabinets.

1.2 RELATED REQUIREMENTS

A. Section 26 0534 - Conduit.

B. Section 26 0537 - Boxes: Switch outlets and installation of switch devices.

C. Section 26 2416 - Panelboards.

1.3 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.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Advanced Control Technologies, Inc: www.act-solutions.com.

B. Cooper Controls www.coopercontrol.com

C. Lutron: www.lutron.com

2.2 NETWORKED LIGHTING CONTROL

A. Description: Distributed switching control using networking programmable relay panels.

B. Networking Hardware and Software: Support 2-wire communications between programmable relay panels, allow global switching and Ethernet control.

2.3 PROGRAMMABLE RELAY PANELS

A. Manufacturers:
   1. Advanced Control Technologies, Inc: www.act-solutions.com.
   2. Lithonia Lighting: www.lithonia.com.
   3. Cooper Controls www.coopercontrol.com
   5. Lutron: www.lutron.com

B. Description: Relay cabinet with power supply, terminal blocks, and shall be microprocessor controlled with an integral display and with a programming keypad.

C. Relays per Panel: As indicated.

D. Programming Functions:
   1. Programmable intelligence shall include Time-Of-Day control, 32 holiday dates, warn occupants of an impending off, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, and local control.
   2. Relays may be designated as either normally open or normally closed from software. Relay status shall not only disclose commanded relay status but next scheduled state to occur.
   3. Each control panel shall provide a Warn Off (flash the lights) to inform the occupants of an impending Off command. The Warn Off command shall provide an adjustable time duration of 1 second to 99 extra minutes. The occupants may exit the premises with adequate lighting or cancel the Warn Off by overriding the lighting zone. This option occurs with all Off commands except local overrides.
   4. The controller shall permit lighting to be overridden On for after hours use or cleaning. The controller shall provide optional switch timer assignments or timed overrides. The override choices for various relays shall provide special event occurrences and the controller shall return to the programmed state. Also, the controller shall provide priority and masking choices to customize the functions of switch inputs, thereby enabling switches to function differently at different times of the day to meet special facility operational requirements. These overrides shall be hard-wired inputs.
   5. Programming the controller shall be through the local integral keypad. Descriptive information shall assist the user to employ the system without a programming manual.
   6. Priorities and/or Masking shall be assigned to inputs, telephone override, and global commands to insure building integrity. Priorities enable or disable the inputs based on Time-Of-Day scheduling in the controller. Masks shall permit: On only, Off only and On & Off control for intelligent after hours utilization of the controlled facility.
   7. The lighting control system may be fully programmed through PC programming software. Programming shall be permitted through a direct RS-232 connection, modem or ethernet.
   8. The control system shall provide networking between lighting control panels. One network may support a maximum of a 127 control panels. Panels shall permit data sharing for global control. All inputs (no limitation) are transferable over the network to create any switching pattern required.

E. Hardware Features:
   1. Operator Interface
      a. The control panel programming interface resides in firmware in the control panel. The programming interface shall consist of a circuit board mounted touch screen capable of linking switch inputs to relay outputs and schedule assignments. Systems that utilize blocking diode technology for relay assignments shall not be acceptable.
      b. The integral touch screen shall provide access to the main programming features. The touch screen shall permit the user to manually command any or all relays individually. Each panel shall control its own loads from internal memory. A control system that relies on a central control computer/processor or external time clocks shall not be permitted.

2. Contact inputs
    a. The control system shall permit 32 dry contacts (Digital/Switch Inputs) for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Maintained contacts shall be supported as 2 wire (SPST) inputs. Inputs shall be dry contacts (24 VDC @ 12 ma. internally supplied to the inputs). An input shall be software linked to any number of relays for override control.
    b. The controller shall provide timers for each switch input. Each switch input timer shall be capable of 0-999 minutes. Software shall enable or disable switch inputs based on Time Of Day scheduling.
3. Relay Type
    a. The system shall utilize control relays which are rated to 20 amps at 277 VAC. The relays shall be magnetically held and are provided in groups of eight. Relays that are latched or mechanically held are not acceptable. The relays shall be rated for 10 million mechanical operations. A limited 10 year warranty shall be provided on the individual relays.
4. Photocell Control
    a. The controller shall accept user adjustable ambient light sensors. The controller shall provide power for the sensor thereby eliminating any external power supply. Sensors shall provide for both outdoor and indoor applications and provide a dry contact to the controller once the threshold is reached. The sensor shall provide user adjustable dead band control.
5. Modular Design
    a. The control system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick release hinge pins that shall permit an entire change out of the processor and input board in less than 1 minute.
    b. All connections for the switch inputs shall incorporate modular connectors. The relay board shall be modular and designed for rapid field replacement or upgrading. Systems that do not employ modular connectors shall not be acceptable.
6. Hardware Output Options
    a. Modular Relay Card (MRC)
        1) The controller shall provide an option for modular relay control. The Modular Relay Card (MRC) shall offer the feature of controlling two pole voltages such as 208, 240, and 480VAC in a Normally Open or Normally Closed configuration. Single pole is offered for 120 and 277VAC in a Normally Open and Absolute Zero Configuration. This relay card shall also provide visual indication of relay status. Relays shall be individually exchangeable with plug in low voltage connectors. Combinations of relays shall be permitted since relay modules shall snap into and lock in location. Two pole modules require two relay locations for a maximum of four two pole relays per card. All other relay modules use 1 relay location for a maximum of eight per card. All Modular Relay Card components shall be warranted for 10 years.
7. Diagnostic Aids
    a. Each control panel shall incorporate diagnostic aids for confirmation of proper operation, or in case of failure these aids shall guide the individual in rapid troubleshooting of the system.
    b. The control panels shall employ both a backlit supertwist LCD and LED=s that indicates:
        1) POWER (LED)
        2) SYSTEM OK (LED)
        3) NETWORK COMMUNICATIONS (LED)
        4) ON/OFF STATUS of EACH RELAY (LED & LCD)
        5) SYSTEM CLOCK and DATE (LCD)
        6) PROGRAMMING CONFIRMATION (LCD) (TOD, HOLIDAY,ON/OFF, & PRESET)
    c. Control systems that do not provide visual self help diagnostics shall not be acceptable.

8. Memory Back-up
    a. The system shall utilize a memory back-up device that is system integrated and shall be non-serviceable. The data in RAM shall be protected against power interruptions lasting as long as 7 days. The power interrupt protection circuit shall be entirely maintenance-free.
9. Multi-tapped Transformer
    a. The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltages of 120 & 277 VAC shall be available with each control panel.
10. Status Indication of Relays
    a. The system shall provide visible status indication of all relays through the window of each control panel. The visual indication shall disclose On/Off status and relay number.
11. Service Override & Priority Override
    a. The control panel shall provide a three position master-service override for the control unit. The service override shall not be accessible from the exterior.
    b. The master service override provides a single three position switch with the option of All Off, Auto, and All On, respectively. This master switch shall operate all of the relays in the controller. This switch shall override and supersede all commands from the logic board when the switch is in the All On or All Off position. The master switch shall function to override all the relays should the logic board programming differ from the space function.
    c. The system shall remember the last command to the individual relays. Upon returning the master override switch to the Auto position, the relays shall return to the most recent command state. This will occur even if the last command happened during the master override condition.
    d. Additionally, the system shall provide external priority override for the entire panel. Through an externally maintained contact the override card shall place the panel in a priority state. This external contact will supersede any other programmed state and will command all the relays ON or OFF depending on operational choice. This priority state will continue until the external contact is removed. Once the external override is removed the control panel will return the relays to the appropriate programmed state.
12. Lockable Enclosure
    a. Each control panel shall be enclosed in a lockable NEMA class 1 enclosure. The enclosure shall be manufactured out of 1/16" steel and shall provide pre-punched knockouts for efficient installation.
13. Panels
    a. The low voltage controller shall exist in two sizes of relay enclosures. The enclosure maximum sizes shall be either 16 or 32 relays per cabinet. The 16 size will employ two relays cards and the 32 will utilize 4 relay cards. Relays shall be provided in groups of eight relays per card.
14. High Voltage Barriers
    a. The low voltage controller shall provide as an option the ability to provide a barrier for either voltage separation or emergency circuit separation. The 16-size enclosure shall permit one barrier and the 32-size enclosure shall permit up to three locations where the barrier(s) may be installed. The barrier shall be painted red to denote the difference.
15. PC Interface (ethernet)
    a. The controller shall permit PC programming through optional software. Programming shall be permitted through either a local connection or remotely via TCP/IP protocol. PC software shall permit multiple file storage for data archival and for seasonal facility requirements. Operator commands may be issued directly from the PC keyboard.

2.4 REMOTE SWITCHES

A. Wall Switch: Pushbutton type with separate on and off buttons.
   1. Description: Momentary contact, three wire switches, ivory color, rated 3 amperes at 25 VAC.

2.5 POWER LIMITED WIRE AND CABLE

A. Remote Control Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with PVC jacket.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation
   1. The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits, and override wiring.

B. Documentation
   1. The contractor shall provide accurate "as built" drawings to the owner for correct programming and proper maintenance of the control system. The "as builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals
   1. The factory shall supply all operation and service manuals.

D. Install all wiring in conduit in accordance with Section 26 0534.

3.2 PRODUCT SUPPORT AND SERVICE

A. Factory Support
   1. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.3 CLOSEOUT ACTIVITIES

A. Provide the services of a factory certified technician for equipment commissioning and startup.

B. Demonstrate proper operation of system.
   1. All system equipment shall operate in accordance with specification and industrial standard procedures.
   2. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.
   3. Demonstration of program integrity during normal operation and pursuant to a power outage.
   4. Contractor shall provide a minimum of one training hour on the operation and use of the control system.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0537 - Boxes.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2716 - Electrical Cabinets and Enclosures.

E. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan speed controllers, and wall plates.

F. Section 26 5100 - Interior Lighting.

G. Section 26 5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 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. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

B. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C. Field Quality Control Reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Leviton: www.leviton.com
   2. Cooper Controls: www.cooperlighting.com
   3. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
   3. Provide LED to visually indicate motion detection.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on manually when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   6. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes.
   7. Sensitivity: Field adjustable.
   8. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
   9. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
   11. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
      c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      f. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
      g. Provide vandal resistant lenses for passive infrared (PIR) wall switch occupancy sensors.

   2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion

within an area of 900 square feet.
3. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Finish: White unless otherwise indicated.
2. Ultrasonic Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on the drawings.

2.3 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com.
2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC: www.tork.com.
4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. Astronomic Time Switches: Two channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: As indicated on the drawings.
8. Output Switch Configuration: As required to control the load indicated on the drawings.
9. Output Switch Contact Ratings: As required to control the load indicated on the drawings.
10. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
a. Indoor clean, dry locations: Type 1.
b. Outdoor locations: Type 3R.
11. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1

C. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface 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.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

K. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

L. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

N. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 2716 for mounting of lighting control device system components.

3.4 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. 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 included with submittals.

C. Test time switches to verify proper operation.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. 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.

D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Location: At project site.

END OF SECTION

26 0933 CENTRAL DIMMING CONTROLS

PART 1– GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Central dimming control system.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
   1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
B. ASTM International (ASTM)
   1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.
C. Canadian Standards Association (CSA).
   1. CSA C22.2 # 14 Industrial Control Equipment
   2. CSA C22.2 # 184 Solid-State Lighting Controls
   3. CSA C22.2 # 156 Solid-State Speed Controls
D. International Electrotechnical Commission.
   1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
   2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.
E. International Organization for Standardization (ISO)
   1. 9001:2000 – Quality Management Systems.
F. National Electrical Manufacturers Association (NEMA)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.
G. Norma Official Mexicana (NOM).
   1. NOM-003-SCFI Productos eléctricos - Especificaciones de seguridad (Electrical products - Safety Specifications)
H. Underwriters Laboratories, Inc. (UL):
   1. 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   2. 508 (1999) - Standard for Industrial Control Equipment.
   3. 1472 (1996) - Solid-State Dimming Controls.
   4. 924 (2003) - Emergency Lighting and Power Equipment.

1.3 SYSTEM DESCRIPTION

A. Centralized dimming control system
   1. Factory assembled dimming and switching panels.
   2. Low voltage wallstations, touchscreens, interfaces, and sensors.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 330.
B. Specification Conformance Document: Indicate whether the submitted equipment:
   1. Meets specification exactly as stated.
   2. Meets specification via an alternate means and indicate the specific methodology used.
C. Shop Drawings; include:
   1. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
   2. Schematic of system.

D. Product Data: Catalog specification sheets with performance specifications demonstrating compliance with specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.
B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
C. Central dimming control system:
    1. Meets UL, cUL, and/or CSA Standards specifically for the required loads. Provide evidence of compliance upon request.

1.6 PROJECT CONDITIONS

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.
    3. Lighting control system must be protected from dust and sprays during installation.

1.7 WARRANTY

A. Provide manufacturer's warranty covering 5 year parts to repair and replace defective equipment.
B. Provide manufacturer's additional warranty options to customer where required.

1.8 COMMISSIONING

A. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
    1. Qualifications for factory-certified field service engineer:
        a. Certified by the equipment manufacturer on the system installed.
    2. Make a visit upon completion of installation of central dimming control system:
        a. Verify connection of power feeds and load circuits.
        b. Verify connection Wallstation controls.
        c. Verify proper connection iCAN link.
        d. Download system panel data to dimming panels.
        e. Check dimming panel load types and currents and remove by-pass jumpers.
        f. Verify system operation control by control, circuit by circuit.
        g. Obtain sign-off on system functions.
        h. User to be trained on system operation.

1.9 MAINTENANCE

A. Make ordering spare parts available to end user.
B. Make new replacement parts available for minimum of ten years from date of manufacture.
C. Provide factory direct technical support hotline.
D. Provide on-site service support where required.
E. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits to customer if desired.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Cooper Controls, – System: iLumin Architectural Control System

B. Basis of design product: Cooper iLumin system or subject to compliance and prior approval with specified requirements of this section, one of the following:
   1. Cooper Controls iLumin
C. Substitutions:
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.
   2. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   3. Any substitutions provided by the contractor shall be reviewed at the contractor's expense by the electrical engineer at a rate of $200.00 per hour.
   4. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.
   5. Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 GENERAL

A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
B. Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.
C. Designed and tested to withstand electrostatic discharges up to 12,000 V without impairment per IEC 801-2.

2.3 DIMMING / RELAY PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate under the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.
B. Design and test dimmers/relays to withstand line-side surges without impairment to performance.
   1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.
   2. Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.
C. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.
D. Power failure memory and dimmer/relay recovery:
   1. When power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
   2. In 3 phase panels loss of power to any phase should not effect operation or control dimmers on any other phase.
E. Dimmers: SC-UN and SC-UN-FT Series
   1. Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage, frequency shifts, dynamic harmonics, and line noise.
   2. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
   3. Each dimmer to be configurable in the field to provide a proper dimming curve for the specific light source.
   4. Minimum and maximum light levels user adjustable on circuit-by-circuit basis.
   5. Each individual circuit must include the ability to control the following load types standard, without additional modules or equipment.
      a. Magnetic Low Voltage (MLV) transformer:

1) Contain circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472, Section 5.11.
2) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.

b. Electronic Low Voltage (ELV) transformer:

c. Dimmer to be approved for use on the specific ELV transformer being used, Dimming equipment manufacturer to offer free testing services to ensure compatibility. Neon and cold cathode transformers:
1) Magnetic transformers: UL listed for use with normal (low) power factor magnetic transformers.

d. Low Voltage Dimming (0-10V); Meet following requirements:
1) Capable of controlling any 0-10V source.
2) 0-10V analog voltage signal.
a) Provide isolated 0-10V output signal conforming to IEC 60929.
b) Sink current via IEC 60929.
c) Source current.

F. Dimmer: SC-RP and SC-RPB Series
a. Up to 24 Low Voltage Dimming (0-10V) channels; Meet following requirements:
1) Capable of controlling any 0-10V source.
2) 0-10V analog voltage signal.
a) Provide isolated 0-10V output signal conforming to IEC 60929.
b) Sink current via IEC 60929.
c) Source current.

G. Variable Relay Timing Technology: SC-RP and SC-RPB Series
1. Each relay shall provide circuitry that will ensure switching the load at the optimum time to ensure minimum current flow.
a. Relay Module shall have the ability to measure voltage, current and frequency of each switched load without additional components.
b. Each Relay Module shall constantly monitor the connected load and will adapt to the changing circuit characteristics. Switching times are adjusted to maintain minimum current flow regardless of changing factors such as ballast or lamp life.
c. Each Relay Module optimizes its own switching time.

2.4 POWER PANELS

A. Product: SC Series.
B. Mechanical:
1. Meets UL, cUL, and/or CSA Standards specifically for the required loads. Provide evidence of compliance upon request.
2. Delivered and installed as a factory assembled panel listed to UL508.
3. Field wiring accessible from front of panel without need to remove dimmer or relay assemblies or other components.
4. Panels passively cooled via free-convection, unaided by fans or other means.

C. Electrical:
1. Panels contain branch circuit protection for each input circuit unless the panel is a dedicated feed-through type panel or otherwise indicated on the drawings.
2. Branch circuit breakers; meet following performance requirements:
a. Listed to UL 489 as molded case circuit breaker for use on lighting circuits.
b. Contain visual trip indicator; rated for:
1) SC-UN: 10,000 AIC, 120 V Dimming and 14,000 AIC, 277 V Dimming.
2) SC-RP: 25,000 AIC, 120 V and 277 V relays

c. Thermal-magnetic construction for overload, short-circuit, and over-temperature protection. Use of breakers without thermal protection requires dimmers/relays to have integral thermal protection to prevent failures when overloaded or ambient temperature is above rating of panel.
d. Replaceable without moving or replacing dimmer/relay assemblies or other components in panel. Breakers shall be designed for use in frequent switching applications (switching duty rated) so that loads can be switched on and off by breakers.

3. Panel to contain 4 line LCD display controller in each panel
   a. All set up and adjustments of the panel can be made from this device.
   b. USB, RS485, Ethernet, and DMX connections must be included.
   c. Include Timeclock standard with control of:
      1) Scene selections.
      2) Fade zone to a level.
4. Real Time Energy Meter per circuit
   a. Electrical device to measure voltage and current within each circuit.
   b. Metered data can be polled via public command string from on board Ethernet input.

D. SC-UN and SC-UN-FT Series
1. Each individual circuit dimmers is designed and tested to specifically control incandescent/tungsten, magnetic low voltage, electronic low voltage, neon/cold cathode, fluorescent dimming ballasts, 0-10V low voltage loads, and non-dim loads without additional internal or external modules.
2. Utilize universal 16A continuous-use dimmer listed to UL508.
3. Limit current rise time to minimum 350 µsec as measured from 10-90 percent of load current waveform at full dimmer capacity at a 90 degree conduction angle.
4. Load faults only affect the given circuit.
5. Ship panels with each dimmer in mechanical bypass position by means of jumper bar inserted between input and load terminals. Jumpers to carry full rated load current and be reusable at any time without requiring a tool to reinstall them. Mechanical bypass device to allow for switching operation of connected load with dimmer removed by means of circuit breaker.

E. SC-RP and SC-RPB Series
1. Replacing relay does not require re-programming of system or processor.
2. Relays: Include diagnostic LED's to verify proper operation and assist in system troubleshooting.
3. Relay panels: Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.
   a. Failures on the lighting control system network are localized to the failed product. All other lighting control panels continue to fully function without additional action. Systems that have a single point of failure on the network shall not be acceptable.
4. If lighting control system fails, lights to remain at current level. Individual relay overrides provides local control of lights until system is repaired. Each lighting control panel includes a master override to override the entire lighting panel.

2.5 LOW-VOLTAGE WALL STATIONS

A. Product: Revio, Ineo, European Style, Architrave, Touchscreens
B. Electronics:
1. Use CAN wiring for low voltage communication to ensure reliable data communication in high electrical noise environments.
C. Functionality:
1. Upon button press, LEDs to immediately illuminate.
D. Color:
E. Provide faceplates with concealed mounting hardware where specified.
F. Engrave wall stations with appropriate button, zone, and scene descriptions as specified.

G. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

2.6 LOW VOLTAGE CONTROL INTERFACES

A. Contact Closure Interfaces; Cooper iLumin UIG-NA and UIM-NA:
   1. Where contact closures are used to integrate between lighting controls and other systems.
   2. The contact closure input device will accept both momentary and maintained contact closures.

B. RS232 Interface; Cooper iLumin SI-2-NA:
   1. SI-2-NA Interface
      a. Provide ability for bi-direction communication by means of RS232 serial communication to system by means of user-supplied PC, digital audiovisual, or BMS equipment. Control to be located within 50 feet (15 meters) of RS232 source.
      b. Allow for custom RS-232 command strings to be entered in to software to allow lighting control system to control any other device.

C. DMX Output Interface; Cooper iLumin SCD96-NA
   1. Provide the ability to control standard DMX devices such as RGB fixtures, moving lights, dimmers and effects.
   2. Provides 96 DMX channels
   3. Provides the ability to map any iLumin wall station button to a DMX channel.

D. Network Repeater/Bridge; Cooper iLumin BN-2-NA
   1. Shall allow the network to extend more than 1000m/3200 feet.
   2. Shall permit the connection of multiple networks allowing up to 65,000 devices on one system.

E. Relay Interface; Cooper iLumin RI-2-NA
   1. Provide eight dry contact programmable low power relays to control curtain, shades, AV screens and other equipment.

F. Infrared Transmitter & Receiver; Cooper iLumin IRTR
   1. Provide the ability to sense the presence or absence of partitions.
   2. Requires the connection to a UIG-2-NA

G. Network Access Jack; Cooper iLumin LCNJ
   1. Shall allow direct access to the iLumin lighting control network while in the space being modified.

2.7 SOFTWARE

A. Energy Monitoring Web Tool; Cooper iLumin Venergy
   1. Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations by monitoring the devices in the system, recording events, indicating alarm conditions, logging and displaying system reports.
   2. Configuration shall be to the point that when additional monitoring devices are added, the user shall only need to convey to the software the communications address and type of the new device. The software shall then be able to display all data from that device in a format identical to that used for other devices of the same type.
   3. The software shall be a standard product offering with no customization required.Clients shall interface with the software via any standard browser application (Internet Explorer, Firefox, Safari, Chrome, etc.) with a Flash plug-in. No additional software application install shall be required for Client communication with the software
   4. Browser based clients shall access server through standard ASP (active server page) interface that is capable of displaying:
      a. Historical Reports that can be customized and saved to users PC.
      b. Graphical displays with real-time data updates
      c. Real-time data and trend displays via TCP connection to monitoring devices.
      d. Electronic documentation (support of .xls)
      e. Setup of client based display preferences.

5. Shall be able to give real-time dynamic alerts on-screen and via text or email
6. Web-enabled software shall support the viewing of interactive graphics in a browser client.
7. Alarms/Events shall be recorded.
8. Alarms shall be user-defined and configurable.
9. Intuitive display of time-series data with user-selectable time scales and intuitive click-and-drag drill-down capability.
10. Drill-down capability to the individual circuit or sensor node.
11. Top Consumer reports with drill-down capability to quickly identify the highest consumers of energy in a building.
12. Shall be able to display 31 days of 24-hour views of data from any node in the system.
13. Monthly summary reports of all utility consumption (electric, gas and water) for any node in the system.
14. Annotation of specific data points to identify anomalies and relate to operational events.
15. Easy comparison of time-series data for up to 9 parameters on a single chart.
16. Shall support multiple utility tariff structures for flat rate, time of day, demand surcharges, and tiered rate for specific calendar periods.

B. Graphical Scene Control Software: Cooper iLumin iCanView
   1. Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations for the selection and operation of lighting scenes
   2. All software shall be programed by the vendor and delivered ready to use. This program shall include preparation of all graphics, and displays required as a part of this project.
   3. Clients shall interface with the software viaCooper Controls iLumin iCANsoft application

2.8 SOURCE QUALITY CONTROL

A. Perform full-function testing on 100% of all system components and panel assemblies at the factory.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer’s installation instructions.
B. Provide complete installation of system in accordance with Contract Documents.
C. Define each dimmer's/relay’s load type, assign each load to a zone, and set control functions.
D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
E. 100 digital devices (Source Controllers, User Interfaces, etc) may reside on a single network segment with a network length not to exceed 3000 feet. Additional network segments shall be accomplished by the employment of a network bridge up to 65000 devices. Network segments shall be terminated at the end of each segment.
F. Devices to be connected via Daisy Chain topology.
G. Network wire recommended is Belden#1502R or 1502P (plenum) or similar. Wire shall meet color code requirements to insure proper installation of the network polarity.
H. All panels are “masters” and may be added to the network in any location and any amount as long as network installation guidelines are met.
I. Panels are designed to function independently from external control devices.

3.2 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of 8 hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.
   5. Provide two copies of video recorded operation and maintenance instructions (format as requested by owner) as described above. Demonstrate actual maintenance procedures for all equipment and systems installed. Demonstrate operation of all systems, including initial start-up.

END OF SECTION

260936 ROOM LIGHTING CONTROLLER SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Occupancy, Vacancy and Daylighting Sensor Control
   2. Emergency Lighting Control (if applicable)

B. Related Section
   1. Section 16 515 – Interior Lighting Fixtures, Lamps, and Ballasts: LED dimming ballasts
   2. Electrical Sections, including wiring devices, apply to the work of this Section

C. Control Intent – Control Intent includes, but is not limited to:
   1. Defaults and pre-defined calibration settings for such items as daylighting, occupancy sensor times, sensitivity, fade rates, etc.
   2. Wallstation pre-defined control sequences
   3. Scene Wallstation programmable control sequences
   4. Daylight sensor and switching zones
   5. Emergency Lighting control

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. Underwriter Laboratories of Canada (ULC)

C. International Electrotechnical Commission (IEC)

D. International Organization for Standardization (ISO)

E. National Electrical Manufacturers Association (NEMA)

F. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. NEMA WD7 -

H. Underwriters Laboratories, Inc. (UL)
   1. 508 – Industrial Control Equipment
   2. 924 – Emergency Lighting

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:
   1. Room Controllers – Three relay controller with 0-10 volt control for ballasts or LED drivers with integral UL 924 emergency relay (model dependent), that RCQK smart devices connect to over the RCQK communications network.
   2. Occupancy Sensors – Auto adjusting, MicroSet technology NEMA WD7 compliant occupancy sensors.
   3. Wallstations – Smart device that is pre-configured, pre-engraved digital pushbutton wallstations and dimmers.

4. Scene Wallstation – Smart device that is pre-configured, pre-engraved digital pushbutton scene wallstations, dimmers and programmable scene buttons.
5. Daylight Photosensor – Smart device that is a multi-zone open loop daylight sensor with two-way active infrared (IR) communications, which can provide dimming control for daylight harvesting and personal control and programming for the space.
6. RCQK communication network – Pre-defined lengths of QuickConnect cable (RJ45) for power and data to smart devices.

1.4 LIGHTING CONTROL APPLICATIONS

A. Minimum lighting control performance required, unless local Energy Code is more stringent.
   1. Occupancy/vacancy requirements – Provide an occupancy/vacancy sensors with Manual On/ Automatic Off or Automatic On/ Automatic Off functionality in all spaces. Manual On vacancy sensors should be used for any enclosed space with a Manual On switch that does not require hands free operation. Spaces with multiple occupants or where line of sight might be obscured ceiling or corner mount sensors and Manual wallstations would be required. Automatic On of lighting via occupancy sensor cannot exceed 30% of lighting. Systems that do that allow the user to select Occupancy or Vacancy Mode shall not be acceptable.
   2. Bi-Level switching – Provide variable dimming for maximum energy savings.
   3. Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by a multi-level photocontrol device without the need for programming. Adjustments to the daylight zones must be provided by a simple to use, intuitive remote handheld device.
   4. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level.
   5. Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.
   6. Provide the ability for the dimmers and the relays to function separately. Systems where the 0-10V dimmers and relays are tied together reduce design capabilities and shall not be acceptable.

1.5 PERFORMANCE REQUIREMENTS

A. The Room Controller QuicKit shall be accompanied by: recessed or suspended luminaires specified as fluorescent or LED with defined CRI and lumen output, provided by the same manufacturer as the control systems.

B. The Room Controller QuicKit shall include: the Room Controller (RC3, RC3D, and RC3DE), wallstations, matching color screwless wallplates, occupancy sensor, Daylight Sensor, Receptacle Switchpack, QuickConnect cable (plenum or non-plenum pre-terminated and defined for package).

1.6 SUBMITTALS

A. Submittals Package: Submit the shop drawings and the product data specified below at the same time as a package.

B. Shop Drawings:
   1. Composite wiring and/or schematic diagram of each control circuit, as proposed, to be installed (standard diagrams will not be accepted).
   2. Scale drawing for each area showing exact location of each sensor, room controller and digital switch.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:
   1. Indicate best mounting and installation locations for each device. This may be contained within drawings or installation instructions depending upon the project.

E. Warranties: Standard and special warranty information.
   1. Provide additional 5 year extended warranty on all hardware and software.

1.7 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years' experience in manufacture of lighting controls.

B. Products: All electrical components and devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency and marked for intended use.

C. Comply with NFPA 70.

D. Source Limitations: Obtain luminaires and control systems from a single manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements.

B. Packaging: All components of the lighting control system shall be packaged in a single box as a QuicKit or as individual components. The QuicKit catalog number will be marked on package label along with bill of materials. Individual component packages will be marked with product catalog number.

C. Handling: Packaging will include clear installation instructions for all components with typical illustrations of installation locations and connections. The installing contractor can easily match each package to the layout on the design floor plans.

1.9 PROJECT CONDITIONS

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

B. Coordinate layout and installation of luminaries and controls with other construction.

C. Coordinate site commissioning with manufacturer no less than 21 days prior to required date.

1.10 WARRANTY

A. Manufacturer shall supply a 5-year warranty on all hardware and software. These warranties will be in effect for all installations. Systems that provide special warranties based on installation shall not be acceptable.

1.11 MAINTENANCE

A. Provide extra materials described below when needed. Products shall match those that are installed. Extra materials should be stored and identified with labels describing contents. Inclusion of extra materials on the bill of materials is not the responsibility of the manufacturer.

B. Recommended extra materials:
   1. Occupancy Sensors: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   2. Daylight Sensors: Provide 1 of each product type for every 100 installed, to be used for maintenance.
   3. Wallstations: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   4. Receptacle Switchpack: Provide 1 of each product type for every 100 installed, to be used for maintenance.
   5. Room Controller: Provide 1 of each product type for every 200 installed, to be used for maintenance.
   6. QuickConnect Cable: Provide 1 of each product type for every 200 installed, to be used for maintenance.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
   1. Eaton Lighting Systems
      a. System: Room Controller QuicKit (RCQK)

B. Substitutions:
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 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.
   2. Any substitutions provided by the contractor shall be reviewed at the contractor's expense by the electrical engineer at a rate of [$200.00] per hour.
   3. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design, highlighted in an alternate color, to the engineer for review and approval prior to rough-in.

2.2 WALL OR CEILING MOUNTED OCCUPANCY PERFORMANCE REQUIREMENTS

A. Sensing mechanism:
   1. Dual technology]
      a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
      c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.

B. Power failure memory:
   1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.

C. Designed and tested to withstand discharges of 15,000 volts per IEC 801-2 without impairment of performance.

D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

E. Sensor shall have time delays from 10 to 30 min.

F. When specified, sensors shall automatically adjust time delay and sensitivity settings.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

I. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.3 CEILING MOUNTED SENSORS

A. Product: [OAC-DT-2000], [OAC-DT-1000], [OAC-P-1500], [OAC-U-2000].

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
   1. [OCC-RJ45] Room Controller accessory is used to allow any standard occupancy/vacancy sensor to utilize Click & Go cable connections.
   2. Two RJ45 connection ports for connection to Room Controller.
   3. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.

E. Device calibration and features:
   1. Sensitivity – 0-100% in 10% increments.
   2. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
   3. Test mode – Fifteen second time delay.
   4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   5. Walk-through mode.
   6. Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.
   7. Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area shall not be acceptable.
   8. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
   9. All load parameters including Automatic On/Manual On, blink warning and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:
   1. PIR Detection
   2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy-chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

J. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

K. Sensors shall be RoHS compliant.

2.4 WALL/CORNER MOUNTED SENSORS

A. Product: [OAWC-P-120W], [OAWC-P-009L-H], [OAWC-DT-120W],

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
   1. [OCC-RJ45] Room Controller accessory is used to allow any standard occupancy/vacancy sensor to utilize Click & Go cable connections.
   2. Two RJ45 connection ports for connection to Room Controller.
   3. Occupancy Sensor and Daylight sensor shall be capable of a daisy-chain connection to the Room Controller.

E. Device calibration and features:
   1. Sensitivity – 0-100% in 10% increments.
   2. Time delay – 1-30, self-adjusts to 10 min. based on room occupancy.
   3. Test Mode – Fifteen second time delay.
   4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   5. Walk-Through Mode.
   6. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
   7. All load parameters including Automatic On/Manual ON, blink warning, and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:
   1. PIR Detection
   2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

J. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

K. Sensors shall be RoHS compliant.

2.5 ROOM CONTROLLER ZONE WALLSTATIONS

A. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:
   1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNL-*], [ENGRV-*BTNS-*]. Button replacement may be completed without removing the switch from the wall.
   2. Intuitive button labeling to match application and load controls.
   3. Pre-defined digital button configurations. Each wallstation is shipped with pre-defined digital button configurations which are automatically sensed by the connected Room Controller and mapped to specific load controls for immediate out of the box functionality.

B. Two RJ-45 ports for connection to the Room Controller local network.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.

D. Room Controller digital wallstations are delivered with pre-defined functions including, raise, lower, A/V Mode, Quiet Time, manual and scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

F. Eaton Lighting Systems catalog numbers:

RC-2TLB-ES1-*	Entry, All Off (2 large buttons *= W,V,B,G)
RC-6TSB-TS1-*	General, Whiteboard, Quiet Time, A/V Mode, Raise, Lower (6 small buttons *= W,V,B,G)
RC-6TSB-TS2-*	General, Whiteboard, Quiet Time, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-5TSB-TS3-*	General, Whiteboard, Quiet Time, A/V Mode, All Off (5 small buttons *= W,V,B,G)
RC-6TSB-TS4-*	General, Whiteboard, A/V Mode, Raise, Lower, All Off (6 small buttons *= W,V,B,G)

RC-4TSB-TS5-*	Entry, General, Whiteboard, All Off (4 small buttons *= W,V,B,G)
RC-6TSB-TS6-*	Entry, General, Whiteboard, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-TS7-*	Row 1, Row 2, Row 3, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-TS8-*	Uplights, Downlights, Accent, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-TS9-*	Entry, General, Quiet Time, Whiteboard, A/V Mode, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-TS10-*	Main, Whiteboard, A/V Mode, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-ZAD-*	Zone 1 UP, Zone 1 DN, Zone 2 UP, Zone 2 DN, Zone 3 UP, Zone 3 DN (6 small buttons *= W,V,B,G)
RC-3TLB-Z1D-*	Zone 1, Raise, Lower (3 large buttons *= W,V,B,G)
RC-3TLB-Z2D-*	Zone 2, Raise, Lower (3 large buttons *= W,V,B,G)
RC-3TLB-Z3D-*	Zone 3, Raise, Lower (3 large buttons *= W,V,B,G)
RC-4TSB-HC1-*	General, Exam, Reading, All Off (4 small buttons *= W,V,B,G)
RC-6TSB-HC2-*	General, Exam, Reading, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-3TLB-OS1-*	Half Lights, Full Lights, All Off (3 large buttons *= W,V,B,G)
RC-5TSB-OS2-*	Half Lights, Full Lights, Raise, Lower, All Off (5 small buttons *= W,V,B,G)
RC-6TSB-OS3-*	Half Lights, Full Lights, Undercabinet, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-2TLB-OS4-*	All On, All Off (2 large buttons *= W,V,B,G)

2.6 ROOM CONTROLLER SCENE WALLSTATIONS

B. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:

1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNL-*], [ENGRV-*BTNS-*]. Button replacement may be completed without removing the switch from the wall.
2. Intuitive button labeling to match application and load controls.
3. Pre-defined digital button configurations. Each scene wallstation is shipped with a pre-defined digital button configuration which is automatically sensed by the connected Room Controller and mapped to specific load controls for immediate out-of-the-box scene based functionality.

B. Two RJ45 ports for connection to the Room Controller local network.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.

D. Room Controller Scene Wallstations are delivered with pre-defined scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

F. Scene wallstations scene control shall be adjustable through a simple interface or handheld control for flexibility of lighting scenes. This personal remote shall allow individual zone control, scene control and scene setting capabilities. [HHPR-RC]

G. Eaton Lighting Systems catalog numbers:

RC-3TLB-P1-*	Scene 1, Scene 2, All Off (3 large buttons *= W,V,B,G)
RC-6TSB-P2-*	Scene 1, Scene 2, Scene 3, Scene 4, Scene 5, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-P3-*	All, On, Scene 1, Scene 2, Scene 3, Scene 4, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-P4-*	Scene 1, Scene 2, Scene 3, Raise, Lower, All Off (6 small buttons *= W,V,B,G)

2.7 DAYLIGHTING ADJUSTMENT HANDHELD REMOTE CONTROLS

A. Battery-operated handheld 10 button configuration for remote daylight sensor configuration. Remote controls shall include the following features:
1. Two-way infrared (IR) transceiver for line of sight communication with the Room Controller daylight sensors within up to 30 feet.
2. Red communication LED on the daylight sensor confirms button press.
3. Inactivity timeout to save battery life.

B. Three intuitive daylight sensor range pushbuttons.

C. Intuitive daylight zone adjustment raise/lower pushbuttons.

D. Eaton Lighting Systems catalog numbers: [HHPRG-RC].

E. Provide three for District Maintenance only.

2.8 ROOM CONTROLLERS

A. Room Controllers are fully functional out-of-the-box to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will include line voltage wiring space and will not require additional electrical junction boxes. The control units will include the following features:

B. Fully functional room configuration to the most energy-efficient sequence of operation based upon the connected devices in the room.

C. Simple replacement – Using the automatic configuration capabilities, a Room Controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

D. Quick installation features including:
   1. Included line voltage space to simplify wiring and eliminate the need for separate junction boxes.
   2. Included emergency voltage space to simplify wiring of emergency luminaire connections.
   3. Breakouts or knockouts for direct conduit connection.
   4. Line and low voltage sections include conduit connection points. Systems that require special accessories for direct conduit connections may not comply with local building codes and shall not be acceptable.
   5. Quick low voltage connections using standard RJ45 QuickConnect cable.
   6. Dual voltage (120/277 VAC, 60 Hz).
   7. Zero cross circuitry for each load.
   8. Three relay configuration.
   9. Efficient 150 mA switching power supply.
   10. Six RJ45 Click & Go local network ports.
   11. All models shall be available in either a plastic or metal enclosure for simplified installation in appropriate spaces
   12. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.

E. On/Off/Dimming Room Controllers shall include:
   1. Three relay, three 0-10V dimming zone configuration [RC3D, RC3D-PL].
   2. Three relay, three 0-10V dimming zone configuration with one emergency UL 924 relay [RC3DE, RC3DE-PL].

F. Eaton Lighting Systems plastic enclosure catalog numbers: [RC3], [RC3D], [RC3DE], [RC3DEHC].

2.9 DAYLIGHT PHOTOSENSORS/ IR RECEIVER)

A. Daylight photosensors work with Room Controllers to provide automatic daylight dimming capabilities for any load type connected to a room controller. Open loop daylight sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Daylight sensors shall be interchangeable without the need for rewiring. Daylight sensors shall be capable of daisy-chaining with occupancy sensors in each room.

B. Digital daylight sensors include the following features:
   1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve.
   2. The daylight sensor has three light level ranges: Low (3-300 lux), High (30-3000 lux), and Direct Sun (300-30000 lux).
   3. For dimming daylight harvesting, the daylight sensor shall provide the capability of controlling multiple (up to three) daylight zones immediately upon connection without programming.
   4. Optional digital wallstations to allow occupants to reduce lighting level to increase energy savings and lower lighting levels for a selected period of time or cycle of occupancy.
   5. Infrared (IR) transceiver for daylight sensor range and daylight zone gain adjustments via handheld remote programmer. [HHPRG-RC]
   6. Infrared (IR) receiver for personal control and scene programming via handheld remote programmer. [HHPR-RC]
   7. Red configuration LED that blinks to indicate data transmission.
   8. Green Mode status LED that blinks to indicate Daylight Commissioning Mode.
   9. Green Mode status LED that remains constant ON when daylight range is set to low for available natural light.
   10. One RJ45 port for connection to Room Controller local network.
   11. An adjustable head and an optional mounting bracket to accommodate multiple mounting methods and building materials. The daylight sensor may be mounted on a ceiling tile, skylight well, suspended lighting fixture or backbox.

C. Open loop digital daylight sensor includes 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 dimming set-points upon power up without any programming. Optional calibration using the wireless IR handheld programmer. [HHPRG-RC]
   3. Eaton Lighting Systems Catalog Number: [DS-FMOIR].

2.10 ROOM CONTROLLER LOCAL NETWORK

A. The Room Controller local network is a physical connection and communication protocol designed to optimally control a space within a building. Room Controller devices connect to the local network using CAT 5e cables with RJ45 QuickConnect cables which provide both data and power to room devices. Features of the Room Controller local network include:
   1. Click & Go default functionality of occupancy sensors, wallstations, slider station, daylight sensors, receptacle controls, BMS status output and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   2. Replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

B. Eaton Lighting Systems Catalog Number:
   1. [GGRC-COUPLER] (Joins two cables)
   2. [GGRC-SPLITTER] (Joins three cables)
   3. NON PLENUM CABLES: [GGRJ45-006-G], [GGRJ45-03-G], [GGRJ45-10-G], [GGRJ45-25-G], [GGRJ45-50-G], [GGRJ45-100-G]
   4. PLENUM CABLES: [GGRJ45-10P-G], [GGRJ45-25P-G], [GGRJ45-50P-G], [GGRJ45-100P-G]

2.11 EMERGENCY LIGHTING

A. Room Controller with emergency relay – The Room Controller is a UL 924 listed device that monitors normal power circuit to the Room Controller. The Room Controller has a dedicated UL 924 output which includes emergency power line in and emergency power load out connections. The UL 924 relay will track with output 1 (Yellow) during normal power operations. Upon loss of normal power the UL 924 output will force the emergency lighting On and full bright (if dimming) until normal power is restored. Features include:
   1. 120/277VAC, 50/60 Hz, 3 amp ballast rating.
   2. Laddarless testing: Push the “All Off” button on any wallstation four times [e-mer-gen-cy], will turn off normal lighting and force UL 924 emergency output On and full bright.
   3. Auxiliary input for remote Alert Mode (All On, and full bright).
   4. Eaton Lighting Systems Catalog Number: [RC3DE], [RC3DE-PL].

PART 3 – EXECUTION

3.1 INSTALLATION

A. The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits.

B. All low voltage smart devices shall connect using QuickConnect wire provided by Eaton's Lighting Systems. When using wire for connections other than the QuickConnect low voltage wire (pre-defined lengths of RJ45 cable), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements.

C. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

D. Provide written or computer-generated documentation on the commissioning 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.).

3.2 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.3 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with twenty one working days written notice of the system startup and adjustment date.

C. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0534 - Conduit: Flexible conduit connections.

1.3 REFERENCE STANDARDS

A. IEEE C57.94 - Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).

B. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 1999 (R2004).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2009.

E. NEMA ST 20 - Dry-Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008

G. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers; 2002.

H. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; 2005.

I. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency; 2000.

J. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

M. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

1.5 SUBMITTALS

A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

B. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

C. Project Record Documents: Record actual locations of transformers.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ALL TRANSFORMERS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 185 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

F. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: Standard efficiency complying with NEMA TP 1.
   1. Test efficiency according to NEMA TP 2.
   2. Label transformer according to NEMA TP 3.

H. Sound Levels: Standard sound levels complying with NEMA ST 20.

I. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA 250: As indicated on the drawings.
   2. Construction: Heavy gage steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

2.4 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install transformers in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

G. Mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

H. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

I. Provide seismic restraints.

J. Provide grounding and bonding in accordance with Section 26 0526.

K. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

L. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.

M. Identify transformers in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

3.4 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Switchboards.

B. Switchboard accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2701 - Electrical Service Entrance.

1.3 REFERENCE STANDARDS

A. NECA 400 - Standard for Installing and Maintaining Switchboards (ANSI); National Electrical Contractors Association; 2007.

B. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2011.

C. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.sea.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. General Electric Company: www.geindustrial.com.

D. Schneider Electric; Square D Products: www.schneider-electric.us.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.2 SWITCHBOARDS

A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.

B. Distribution Section Devices: Panel mounted.

C. Bus Material: Aluminum with tin plating, standard size.

D. Bus Connections: Bolted, accessible from front for maintenance.

E. Ground Bus: Extend length of switchboard.

F. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.

G. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

H. Ground Fault Sensor: Zero sequence type.

I. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 10 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.

J. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with Section 26 2701.

K. Pull Section:

1. Arrange with pull section on left side of switchboard as viewed from the front.

L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

M. Enclosure: Type 2 - Raintight.
1. Align sections at front and rear.
2. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Section 03 3000.

B. Verify that field measurements are as indicated on shop drawings.

3.2 INSTALLATION

A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

B. Install in a neat and workmanlike manner, as specified in NECA 400.

C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

D. Identify switchboards in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

3.4 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated.

D. Adjust circuit breaker trip and time delay settings to values as instructed by Architect.

3.5 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

E. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.

G. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 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 the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.sea.siemens.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. General Electric Company: www.geindustrial.com.

D. Schneider Electric; Square D Products: www.schneider-electric.us.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by a single manufacturer and obtained from a single supplier.

2.2 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. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees 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.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
   3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. 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:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.
    a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

L. Load centers are not acceptable.

M. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase and Neutral Bus Material: Aluminum.
2. Ground Bus Material: Copper.

D. Circuit Breakers:
1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

F. Description: NEMA PB 1, circuit breaker type.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on or plug-in type unless otherwise indicated.

   1. Provide a minimum of six spare 20 amp, 1-pole breakers in each branch panel.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. 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.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 22,000 rms symmetrical amperes at 240 VAC or 208 VAC unless noted otherwise.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. 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.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      b. Provide interchangeable trip units.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   6. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
      c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
   8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
   9. Do not use tandem circuit breakers.
   10. Do not use handle ties in lieu of multi-pole circuit breakers.
   11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

12. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

I. Provide grounding and bonding in accordance with Section 26 0526.
    1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
    2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

J. Install all field-installed branch devices, components, and accessories.

K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

M. Set field-adjustable circuit breaker tripping function settings as directed.

N. Set field-adjustable ground fault protection pickup and time delay settings as directed.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

Q. Identify panelboards in accordance with Section 26 0553.

R. Provide protection for installed breakers during construction to prevent physical damage, paint splatters, etc.

S. Arrange conductors neatly within enclosure, and secure with suitable nylon ties.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

C. Test GFCI circuit breakers to verify proper operation.

D. Correct deficiencies and replace damaged or defective panelboards or associated components.

E. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262701 - ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metering transformer cabinets.

1.2 RELATED REQUIREMENTS

A. Section 26 2413 - Switchboards: Metering transformer compartment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SYSTEM DESCRIPTION

A. System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.

B. Service Entrance:

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.

C. Submit utility company-prepared drawings.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with utility company written requirements and NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. GE Industrial: www.geindustrial.com.

B. Milbank Manufacturing: www.milbankmfg.com.

C. Square D: www.squared.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.2 COMPONENTS

A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.

B. Utility Transformer Pad: Concrete reinforced as specified by Power Company.

C. Other Components: As required by utility company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Arrange with utility company to obtain permanent electric service to the Project.

B. Verify that field measurements are as indicated on utility company drawings.

3.2 INSTALLATION

A. Install transformer pad, metering transformer cabinets, and meter base as required by utility company.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION`

SECTION 262717 - EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to HVAC, shop, kitchen, laundry and other equipment furnished by others.

1.2 RELATED REQUIREMENTS

A. Section 26 0534 - Conduit.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 0537 - Boxes.

D. Section 26 2726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 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.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to 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 2818.

C. Wiring Devices: As specified in Section 26 2726.

D. Flexible Conduit: As specified in Section 26 0534.

E. Wire and Cable: As specified in Section 26 0519.

F. Boxes: As specified in Section 26 0537.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 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.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.2 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).

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 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

F. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

G. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

H. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 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. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish two of each style, size, and finish wall plate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.

C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

D. Substitutions: See Section 01 6000 - Product Requirements.

E. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide GFI protection for all receptacles installed within 6 feet of sinks.

E. Provide GFI protection for all receptacles installed in kitchens.

F. Provide GFI protection for all receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.3 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Finishes:
   1. All Wiring Devices: Verify color with Architect before ordering devices.
   2. Wiring Devices Installed in Finished Spaces: Ivory with stainless steel wall plate unless otherwise indicated. Verify color with Architect before ordering.
   3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.
   4. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

5. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

2.4 WALL SWITCHES

A. All Wall Switches: 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; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, three way, or four way as indicated on the drawings.

2.5 RECEPTACLES

A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, tamper resistant, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

C. GFI Receptacles:
   1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFI Receptacles: Commercial specification grade, tamper resistant, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

2.6 WALL PLATES

A. All 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. Type: Stainless steel.
   4. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Weatherproof Covers for Damp and Wet Locations: Gasketed, heavy duty, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

D. Decorative Cover Plates: Smooth stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 conditions are satisfactory for installation prior to starting work.

3.2 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.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 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 0537 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.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches 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. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

E. 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.

F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.

K. 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.

L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

M. Use jumbo size plates for outlets installed in masonry walls.

N. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install convenience receptacle 18 inches above finished floor.

B. Install convenience receptacle 6 inches above counter.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262818 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

B. Fusible switches.

1.2 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within 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. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an 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 enclosed switch internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA KS 1 and 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:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

M. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA- 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify enclosed switches in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor controllers.

B. Magnetic motor controllers.

C. Combination magnetic motor controllers and disconnects.

1.2 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).

C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000 (R2010).

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).

E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Same as panelboard manufacturer.

2.2 MANUAL CONTROLLERS

A. Manual Motor Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, and toggle operator.

2.3 AUTOMATIC CONTROLLERS

A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Coil Operating Voltage: 120 volts, 60 Hertz.

C. Enclosures: NEMA ICS 6, Type 1.

2.4 ACCESSORIES

A. Auxiliary Contacts: NEMA ICS 2, 2 normally open contacts in addition to seal-in contact.

B. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty oil-tight type.

C. Pushbuttons: Unguarded type.

D. Indicating Lights: Transformer, LED type (green run, red stop).

E. Selector Switches: Rotary type.

F. Control Power Transformers: 120 volt secondary, as scheduled. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

2.5 DISCONNECTS

A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.

B. Thermal Magnetic Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole; UL listed.

C. Motor Circuit Protector: Circuit breakers with integral instantaneous magnetic trip in each pole; UL listed.

D. Non-fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle.

E. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

C. Provide supports in accordance with Section 26 0529.

D. Height: 5 ft to operating handle.

E. Provide fuses for fusible switches; refer to Section 26 2813 for product requirements.

F. Select and install overload heater elements in motor controllers to match installed motor characteristics.

3.2 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.16.1.

END OF SECTION

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 Summary

A. Includes But Not Limited To -
   1. Provide new diesel engine driven emergency generator as shown on drawings. Including:
      a. Diesel engine driven electric generating set to provide standby power.
      b. Automatic load transfer control to provide automatic starting and stopping including control conduit and conductors.
      c. Mounted accessories as specified.
      d. Weather protective enclosure
      e. Remote annunciator panel

1.2 Quality Assurance

A. Requirements of Regulatory Agencies:
   1. The electric generating system consists of a prime mover, generator, governor, coupling and all controls which must have been tested as a complete unit on a representative engineering model as required by NFPA 110-1985. The tests, being potentially damaging to the equipment tested, must not be performed on the equipment to be sold, but on a separate prototype model.
   2. Conform to N.E.C. and applicable inspection authorities.
   3. Transfer switches to be labeled under UL 1008.

B. SHOP DRAWINGS: Submit dimensioned shop drawings of all emergency electrical system components and accessories including but not necessarily limited to emergency generator, protective enclosure, fuel tank, automatic transfer switch, battery charger, all instruments and accessories, and fuel piping requirements. Show accurately scaled layouts of system components. Submittals shall include complete system interconnection wiring diagrams and manufacturer's warranty form indicating compliance with these specifications.

C. OWNER'S MANUALS: Four (4) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

PART 2 - PRODUCTS

2.1 Equipment

A. Provide electrical generating set rated for continuous standby service at values indicated on drawings.

B. Approved Manufacturers:
   1. Nixon Detroit Diesel
   2. Onan
   3. Kohler
   4. Caterpillar
   5. Cummings
   6. Generac

C. Vendors qualifications to bid must include availability of parts and service on a 24-hour basis which must be substantiated in writing prior to bid.

2.2 Engine

A. Provide engine of diesel-fueled, turbo charged, 4-cycle, 8-cylinder, cubic inch displacement type.

B. Provide full pressure lubrication using a lube oil pump. Furnish engine with air cleaner and oil filter with replaceable elements, a lube oil cooler, fuel filters and carburetor replaceable air cleaner and automatic choke.

C. Govern engine speed using an electronic governor to maintain alternator frequency within three cycles (5%) from no load to full load alternator output. Provide a 24-volt D.C. battery charging alternator and voltage regulator. Provide remote starting using a 24-volt electric starter.

D. Power plant to contain engine start-stop controls and cranking limiter to cycle engine starting circuit for 15 second intervals with 5 seconds between starts. Design controls to open engine starting circuit in 90 seconds if engine is not started within that time. Provide engine control panel with solid state engine monitor, individual fault pilot lamps, and shut-down for over-crank/over-speed/high temperature/low oil pressure.

E. Engine Instruments: Provide a unit mounted console with the following gauges:
   1. Run-stop-remote switch
   2. Remote starting, 12-volt, 2 wire
   3. Coolant temperature gauge
   4. Field circuit breaker
   5. DC voltmeter
   6. Running time meter
   7. Lamp test switch
   8. Engine preheat switch
   9. Oil pressure gauge
   10. Fault reset switch
   11. Cycle cranking
   12. Time delay start/stop
   13. 7-Light engine monitor with individual 1/2 amp relay signals and a common alarm contact for each of the following conditions:
      a. Run
      b. Pre-warning for low oil pressure
      c. Pre-warning for high coolant temp
      d. Low oil pressure shutdown High coolant temperature shutdown
      e. Over-crank shutdown
      f. Over-speed shutdown
   14. AC Voltmeter (dual range)
   15. AC Ammeter (dual range)
   16. Voltmeter/ammeter phase selector switch with an off position
   17. Frequency meter
   18. AC Rheostat (panel mounted) for plus or minus 5% voltage adjust

F. Engine Protection Devices: Provide the following engine protection devices with indicating light annunciation for each device:
   1. Low-Oil pressure cut-out
   2. High air temperature cut-out
   3. Over-speed Cut-out

G. Isolators: Provide spring isolators between the electric set and base. Spring isolators between the engine and the base are acceptable if in accordance with manufacturer's recommendations.

2.3 Alternator

A. Provide alternator of four-pole, three-phase, single bearing, revolving field design. Provide twelve lead, re-connectable temperature compensated, solid state, voltage regulator and brushless rectifier exciter system. Provide a rear-mounted junction box for all local connections.

B. Frequency regulation not to exceed 3 Hz. Maintain voltage regulation within plus or minus 2% of rated voltage.

C. This voltage must be maintainable for a minimum period of 30 seconds without tripping overcurrent devices in generator of causing overheating of any component beyond its design/limits. System must recover to stable operation within two seconds. Provide a rheostat to allow adjustment of rated voltage through plus or minus 5%.

D. Alternator instrument panel: shock-mounted, wired and tested prior to shipment. Instrument panel to contain the following:
   1. Panel lighting with ON-OFF switch.
   2. AC voltmeter, 3-1/2", 2% accuracy.
   3. AC ammeter, 3-1/2", 2% accuracy.
   4. Frequency meter, 3'1/2", dial type.
   5. Ammeter-Voltmeter phase selector switch.
   6. Automatic starting controls as specified.
   7. Voltage level adjustment rheostat.
   8. Automatic engine shutdown with mode selector switch for "off, manual, automatic, and test" positions with individual fault indicator lights for low oil pressure, high water temperature, overspeed and overcrank.
   9. Sensor devices with visual prealarm to indicate: running time meter, oil pressure (low), battery charging ammeter and water temperature gauges with visual warning device to indicate high or low water temperature.
   10. Governor speed control switch.

2.4 Main Line Circuit Breaker

A. I-Line type molded case.

B. Install breaker as generator load circuit interrupting and protection device.

2.5 Coolant Heater

A. Provide electric water jacket heater, thermostatically controlled in engine coolant system as a cold weather starting aid as required to maintain 70^{o} F water jacket temperature.

B Heater rated at 208 volts A.C. and connected permanently to circuit from building electrical system.

2.6 Starting Battery

A. Provide sealed, wet cell, heavy-duty, lead-acid type batteries with the standby power plant. Select batteries for starting requirements of standby power plant and rack mount in insulated steel rack within plant housing.

B. Provide sufficient capacity for cranking the engine for at least 30 seconds at firing speed with capacity for starting the diesel engine a minimum of four times. Provide capacity and voltage recommended by engine manufacturer. Provide all intercell and connecting battery cables as required.

C. Provide an automatic dual rate battery charger manufactured by the engine-generator set supplier. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The output voltage is to be determined by the charge current rate. The charger must have a maximum open circuit voltage of 35 volts and be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

2.7 Muffler

A. Provide exhaust silencer as recommended by the manufacturer.

B. Provide condensate trap and pet cock drain installed in the silencer. Provide flexible sections between the engine exhaust manifolds and the silencer.

2.8 Fuel System

A. Equip engine with primary and secondary fuel filters with replaceable elements, and an engine driven fuel pump, all mounted on the engine. Provide fuel system piping of size and type recommended by the engine manufacturer.

B. The fuel system shall include base-mounted fuel tank sized for 24 hours of run time at full load. It shall have the structural integrity to support the engine-generator set. Minimum features shall include all welded double-wall construction, a lockable fuel filler cap, fuel gauge, fuel line check valve and fittings for fuel supply, return, fill and vent and leak detection. This tank must be supplied and warranted by the engine-generator set manufacturer and be factory installed.

C. Provide remote leak detection alarm control panel complete with conduit & monitor wiring at a location determined by the Owner.

2.9 Weather Protective Enclosure:

A. The engine-generator set shall be factory enclosed in a heavy gauge steel enclosure constructed with corner posts, coated with electrostatically applied zinc and finished with baked enamel paint. The enclosure is to have large, hinged doors to allow access to the engine, alternator and control panel. Each door is to be fitted with stainless steel, lockable hardware with identical keys. Padlocks do not meet this specification.

2.10 Automatic Load Transfer Switch

A. Provide 4-pole automatic load transfer switch of amperage ratings indicated on drawings. Approved Manufactures:
   1. ASCO
   2. Russell,
   3. Onan
   4. Kohler
   5. Generac

B. Controls:
   1. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.
   2. A solid state undervoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific applications needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down line voltage to 24VAC, helping to protecting the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
   3. Signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid state time delay start (adjustable, .1 to 10 seconds) shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.
   4. Transfer the load to the engine-generator set after it reached proper voltage (adjustable, 70% to 90%) and frequency (adjustable, 80% to 90%). A solid state time delay (adjustable, 5 seconds to 3 minutes) shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.
   5. Retransfer the load to the line after normal power restoration. A return to utility timer (adjustable, 1 to 30 minutes) shall delay this transfer to avoid short term normal power restoration.
   6. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.
   7. Signal the engine-generator to stop after the load retransfers to normal. A solid state engine cool down timer (adjustable, 1 to 30 minutes) shall permit the engine to run unloaded to cool down before shutdown.
   8. Provide an engine minimum run timer (adjustable, 5 to 30 minutes) to ensure an adequate engine run period.
   9. Provide a solid state plant exercise clock to set the day and time of generator set exercise period. Actual time of day and exercise time shall be displayed. The clock shall have a one week cycle and be powered by the load side of the transfer switch. A battery must be supplied to maintain the circuit board energized when the load side of the transfer switch is de-energized. Include a switch to select if the load will transfer to the engine-generator set during the exercise period.
   10. The transfer switch shall have a time delay neutral feature to provide a time delay (adjustable, .1 to 10 seconds) during the transfer in either direction, during which time the load is isolated from both power sources. This allows residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass this feature when immediate transfer is required.
   11. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.
   12. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set.
   13. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.

14. Provide a safety disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.
15. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on, engine warmup, engine warmup bypass, standby voltage "ready', standby frequency "ready", standby on, transfer to standby, return to utility, engine cool down, engine minimum run and fast test mode.

C. Enclosure -
1. NEMA Type 3R enclosure and locking door.

2.11 Remote Annunciator Panel

A. Provide a remote annunciator panel complete with conduit and monitor wiring at a location determined by the Owner with the following features:
1. Provide visual indication of 20 separate alarm conditions. The panels shall monitor and be labeled as follows:
a. GENSET RUNNING (Green)
b. HIGH TEMP (Amber)
c. LOW OIL PRESS (Amber)
d. LOW TEMP (Amber)
e. LOW FUEL (Amber)
f. HIGH TEMP (Red) LOW OIL PRESS (Red)
g. OVERCRANK (Red)
h. OVERSPEED (Red)
i. NOT IN AUTO (Red-flashing)
j. BLANK (Red)
k. BLANK (Red)
2. Switchable lenses and alarm horn function.
3. Removable legend plates for engraving alarm or status labels.
4. Alarm silence button on annunciator resets circuit for any subsequent fault condition whether or not initial fault has been cleared.
5. Designed for operation at 24 VDC, with negative ground signals.
6. Stainless steel front panel for flush or surface mounting. Refer to drawings for mounting requirements.
7. Knockouts for conduit connections.
8. Replaceable 25,000 hour high intensity lamps for easy readability, high reliability, and low power consumption.
9. Lamp Test/Alarm silence switch.

PART 3 - EXECUTION

3.1 Standby Electric Power System

A. Certify in writing performance of plant, with respect to full power rating, voltage and frequency regulation and motor starting capability.

B. Anchor plant to 9" thick concrete base reinforced with No. 4 bars 12" on center both directions and provided with minimum 3/4" galvanized steel anchor bolts in accordance with applicable seismic zone requirements by structural engineer.

C. Provide sheet metal ducting as required from air transfer grill to radiator.

D. Provide separate conduit and conductors for ATS control circuits, block heater, and battery charger.

E. On completion of installation, have the engine manufacturer's trained dealer service representative provide startup and verify system will start automatically, transfer automatically, initiate and indicate alarms on panel while subjected to a four-hour full load test through the use of portable dry-type load banks supplied for this purpose or by use of actual building loads.

F. On completion and final acceptance of installation, fill fuel tank, lubricating oil, engine coolant, etc. to full capacity.

G. Furnish typed test report to architect. Include letter of approval by local authorities in report.

3.2 Service:

A. Supplier of the electric set and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

3.3 Warranty:

A. The standby electric generating system components, complete engine-generator, instrumentation panel, and automatic transfer switch shall be warranted by the manufacturer against defective materials and factory workmanship for a period of one year. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for travel and labor. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgement of the specifying authority, the manufacturer supplying the warranty for the complete system must have the financial strength and technical expertise with all components supplied to provide adequate warranty support.

END OF SECTION

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic Transfer Switch.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Housekeeping pads.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 3213 - Engine Generators: Testing requirements.

1.3 REFERENCE STANDARDS

A. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment; National Electrical Manufacturers Association; 2005.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

C. 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.

D. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.

E. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ASCO Power Technologies, LP: www.asco.com.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. Russelectric: www.russelectric.com.

D. Generac: www.generac.com

E. Kohler: www.kohlerpower.com

F. Cummins: www.cummins.com

G. Substitutions: See Product Requirements.

2.2 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 10, automatic transfer switch suitable for use as service equipment.

B. Configuration: Electrically operated, mechanically held transfer switch.

2.3 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 10.

B. Temperature: 110 degrees F.

C. Altitude: 4500 feet.

2.4 COMPONENTS

A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

D. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Enclosure: NEMA 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for transfer switch installation.

3.2 PREPARATION

A. Provide housekeeping pads under the provisions of Section 03 3000.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's technical representative to check out transfer switch connections and operation and place in service.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of transfer switch in bypass, normal, and emergency modes.

3.6 MAINTENANCE

A. Provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

END OF SECTION

SECTION 264300 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding.

B. Section 26 2413 - Switchboards.

C. Section 26 2416 - Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; Revision C, 2009.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

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

E. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

F. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

G. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

B. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283.

C. Qualification Data: Provide the following:
   1. Provide test reports from a recognized independent testing laboratory verifying the COMPLETE SPD will survive the published and specified maximum surge current rating. Test reports will clearly show that all components that make up a COMPLETE system were included in these tests (including but not limited to all necessary fuses, thermal disconnects, integral disconnects and monitoring systems). Testing shall be performed as described in the rescinded NEMA LS-1 document (1992). Less than 10% change in protective characteristics from pre to post test.
   2. Provide test data confirming that the SPD will survive the published and specified repetitive surge current rating (longevity characteristic).
   3. Per the requirements of NEC Article 285.6, provide test data demonstrating that the SPD is capable of surviving the published and specified short circuit current capability (AIC rating) without the use of external fusing.
   4. Provide a COMPLETE set of test and ratings data per the recommendations of NEMA LS1 - 1992.

D. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. “Manufactured in accordance with” is not equivalent to UL listing and does not meet the intent of this specification.

E. SPD and performance parameters shall be posted at www.UL.com under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

B. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: As indicated under product article(s) below.

B. Field-installed, Externally Mounted Surge Protective Devices:
   1. Advanced Protection Technologies, Inc (APT): www.aptspd.com.
   2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com.
   3. General Electric Company: www.geindustrial.com.
   4. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com.
   5. Emerson - Liebert.

C. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 ALL SURGE PROTECTIVE DEVICES

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings. The SPD will be capable of surviving 6,000 ANSI/IEEE C62.41, Category C3 (10kA) impulses without failure or performance degradation of more than 10%. The SPD will be integrally fused to pass the requirements of UL-1449 and provide a short circuit current rating of 200kAIC. Each MOV shall be individually matched to + or - 1 volt and individually fused. LED indicator lights for power and protection status. Audible alarm, with silencing switch, to indicate when protection has failed. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status

B. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

C. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 800 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
   2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2000 for L-L mode.

D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.
   2. Outdoor locations: NEMA 4.

F. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
   2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted SPDs.

B. List and label as complying with UL 1283 and UL 1449, Type 1.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 125 kA per mode/250 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. EMI/RFI Filtering: Provide UL 1283 EMI/RFI filter to attenuate electrical noise for Type 2 locations.
   1. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

I. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

J. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1283 and UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 2,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. EMI/RFI Filtering: Provide UL 1283 EMI/RFI filter to attenuate electrical noise.
   1. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

I. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection status.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of the drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install SPD in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on line side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably be rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

A. A. Provide factory testing documents. Verify that electrical wiring installation complies with manufacturer's installation requirements.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes for Electrical Systems.

B. Section 26 0553 - Electrical Systems Identification: Identification products and requirements.

C. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 5600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

B. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

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

H. NFPA 101 - Life Safety Code; 2015.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 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 the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. 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.
      b. Include IES LM-79 test report upon request.

B. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Conform to requirements of NFPA 70 and NFPA 101.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide two year manufacturer warranty for all LED Drivers.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.10 EXTRA MATERIALS

A. Furnish 10% of the total of each plastic lens type used on the project, minimum two of each type. Deliver to owner in protected, factory packaging.

B. Furnish 10% replacement LED engines of major fixture type quantities. Deliver to owner in protected, factory packaging.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 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, ballasts, 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.

I. 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.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 DRIVERS

A. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five 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. Wall Dimmers: See Section 26 2726.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 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 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. 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 surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. 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.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. 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.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Mount fixtures as called for on drawings. Determine type of ceiling being installed in each space and furnish fixtures suitable for exact type, including roof/floor or ceiling/floor fire rated design with fire tenting required by Architect. All coordination and materials to be provided without additional cost to owner.

J. Review lighting drawings and confirm ballast voltages for each fixture, or need for two ballasts to accommodate dual-level switching, or need for dimming ballasts to interface with dimming control, before ordering. Contractor shall not be eligible for additional compensation if fixtures are delivered with incorrect voltage ratings or too few ballasts, or non-dimming ballasts, as a result of inaccurate catalog numbers on drawings.

K. Provide all necessary supports, brackets, adapters and miscellaneous equipment for mounting and installation of fixtures.

L. Surface Mounted Fixtures: Install plumb and square and aligned with building lines and with each other; secure to prevent movement.

M. Install accessories furnished with each luminaire.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

P. Bond products and metal accessories to branch circuit equipment grounding conductor.

Q. Remote Ballasts: 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.

S. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

T. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 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.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean finishes and touch up damage.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.9 SCHEDULE - See Drawings

END OF SECTION

SECTION 265561 - THEATRICAL LIGHTING DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Stage lighting units and lamps.

B. Dimming distribution connectors.

1.2 REFERENCE STANDARDS

A. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. Shop Drawings: Indicate layout of rack-mounted equipment and details and diagrams of interconnecting wiring.

B. Product Data: Provide for each item of equipment, showing sizes and ratings.

C. Project Record Documents: Record actual locations of dimmer outlets and circuiting arrangements.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 STAGE LIGHTING UNITS AND ACCESSORIES

A. Furnish products as indicated in Schedule included on the Drawings.

B. Power Distribution Equipment
   1. General
      a. Connectors shall be 20A Edison. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the circuit ampacity. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C.
      b. Terminations shall be at one end using feed through terminals individually labeled with corresponding circuit numbers. 20 amp circuits shall use screwless tension clamp terminals listed for 20 - 8 gauge wire.
      c. Equipment, except for wall-mounted boxes, shall be supplied with appropriate brackets and hardware for mounting as shown on the drawings. Connector strips shall have brackets on 5' centers. Brackets shall be 1½” x .188” ASTM A 36 steel and hardware shall be ASTM A307 grade 5.
   2. Recessed Wall Pockets
      a. 18-gauge cold rolled steel with 16 gauge covers
      b. Finish: scratch-resistant, black powder coat paint
      c. Circuit labels: 3/4" white lettering on black back-ground
      d. Receptacles: NEMA 5-20R

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Provide the services of a manufacturer representative to prepare and start systems.

C. Aim and adjust luminaires as directed.

D. Clean electrical parts to remove conductive and harmful materials.

E. Remove dirt and debris from enclosure.

F. Clean photometric control surfaces as recommended by manufacturer.

G. Clean finishes and touch up damage.

3.2 CLOSEOUT ACTIVITIES

A. Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

3.3 SCHEDULE - See Drawings

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

C. Concrete pole bases.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding.

C. Section 26 0537 - Boxes for Electrical Systems.

D. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.

E. Section 26 5013 - Luminaire Schedule.

1.3 REFERENCE STANDARDS

A. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2015.

B. IEEE C2 - National Electrical Safety Code; 2012.

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

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

H. UL 1598 - Luminaires; Current Edition, Including All Revisions.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 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 the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

B. 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.
      b. Include IES LM-79 test report upon request.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 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.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.8 WARRANTY

A. Provide three year manufacturer warranty for all LED luminaires, including drivers.

1.9 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the Drawings.

2.2 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, ballasts, 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. 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.

2.3 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Material: Steel, unless otherwise indicated.
   3. Shape: Square straight, unless otherwise indicated.
   4. Finish: Match luminaire finish, unless otherwise indicated.
   5. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 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. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
         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 anchor base covers or anchor bolt covers as indicated.

3. Grounding:
    a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

G. Install accessories furnished with each luminaire.

3.3 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.4 ADJUSTING

A. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

B. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.5 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.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.7 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.8 SCHEDULE - See Drawings

END OF SECTION

LIGHTING SPECIFICATION
PREPARED FOR

Duchesne High School

Football, Baseball, Softball Lighting Project
Duchesne, Utah
March 15, 2022

Project # 218246

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SECTION 265668 – EXTERIOR ATHLETIC LIGHTING

Lighting System with LED Light Source

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for Duchesne High School Football, Baseball, Softball using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.

C. The sports lighting will be for the following venues:

1. Football
2. Track
3. Baseball
4. Softball

D. The primary goals of this sports lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 25 years.
2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
3. Cost of Ownership: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
4. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.
5. Entertainment Features: (Football Only) Incorporation of theatrical light shows enhance the presentation and enjoyment of players and spectators. Control system shall incorporate pre-programmed light shows such as "chase", “wave”, and “score.” Control system shall incorporate the ability to initiate these shows locally. System shall be able to time light shows to customer-supplied music.

1.2 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Football	50 Footcandles	2.0.:1	72	30' x 30'
Track	20 footcandles	N/A	48	30' x 30'
Baseball	50 footcandles Infield 30 footcandles Outfield	2.0:1 Infield 2.5:1 Outfield	25 Infield 98 Outfield	30' x 30'
Softball	50 footcandles Infield 30 footcandles Outfield	2.0:1 Infield 2.5:1 Outfield	25 Infield 77 Outfield	20' x 20'
Bullpens	30 footcandles	2.0:1	14 Baseball BP 12 Softball BP	
Bleachers FB – Home	15 Footcandles	N/A	26	20' x 20'
Bleachers FB - Visitor	4 footcandles	N/A	8	20' x 20'

B. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.

C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
2	F1-F2	90' New
2	F3-F4	80' New
6	A3-A4, B3-B4, C3-C4	60' Existing
6	A1-A2, C1-C2, D1-D2	70' Existing
2	B1-B2	80' Existing
6	SB3-SB4, TB3-TB4, TC3-TC4	60' New

Sports Complex Only - Existing poles to be reused and retrofit with new pole top fitter/crossarms and LED lighting. New concrete piers to be provided by manufacturer. Any wood pole to be removed and not used.

1.3 ENVIRONMENTAL LIGHT CONTROL

A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers, and external shields. No symmetrical beam patterns are accepted.

B. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following levels taken at 3 feet above grade.

Football – W Main Street	Maximum
Specified Spill Line Horizontal Footcandles	.3 fc
Specified Spill Line Max Vertical Footcandles	.5 fc
Specified Spill Line Max Candela	<20,000 cd

Baseball – Softball: Property Line North	Maximum
Specified Spill Line Horizontal Footcandles	<1 fc
Specified Spill Line Max Vertical Footcandles	<1.5 fc
Specified Spill Line Max Candela	<26,000 cd

C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.

D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

1.4 Cost of Ownership

A. Manufacturer shall submit a 25-year Cost of Ownership summary that includes energy consumption, anticipated maintenance costs, and control costs. All costs associated with faulty luminaire replacement - equipment rentals, removal and installation labor, and shipping - are to be included in the maintenance costs.

PART 2 – PRODUCT

2.2 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired, and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:

1. Galvanized steel poles and cross-arm assembly for Football. Reuse existing poles in new locations for Baseball and Softball. Manufacturer will provide new pole top cross-arm assemblies and concrete piers.

2. Non-approved pole technology:

   a. Square static cast concrete poles will not be accepted.

   b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.

3. Lighting systems shall use concrete foundations. See Section 2.4 for details.

   a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection; actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.

b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-inforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.

4. Manufacturer will supply all drivers and supporting electrical equipment

   a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.

   b. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.

5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.

7. Control cabinet to provide remote on-off control, monitoring, and entertainment features of the lighting system. See Section 2.3 for further details.

8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

   a. Integrated grounding via concrete encased electrode grounding system.

   b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: 240 Volt, 1 Phase
   2. Maximum total voltage drops: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The kW consumption for the field lighting system shall be 61.80 kW (FB), and 81.24 kW (BB/SB).

2.3 CONTROL

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

C. Dimming: System shall provide for 3-stage dimming (high-medium-low). Dimming will be set via scheduling options (Website, app, phone, fax, email)

D. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

E. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

F. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Report hours saved by using early off and push buttons by users.

G. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.

H. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.

I. **Football Only:** Entertainment Features: Control System shall store six (6) preprogrammed light shows per field with option for customized scenes. Shows shall be initiated by a manufacturer-provided touchscreen user interface on the control system network.

2.4 STRUCTURAL PARAMETERS

A. Wind Loads: Wind loads shall be based on the 2018 International Building Code. Wind loads to be calculated using ASCE 7-16, an ultimate design wind speed of 105 mph and exposure category C.

B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. Project has two separate geotechnical reports available for us in base designs.

D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:

1. Providing engineered foundation embedment design by a registered engineer in the State of Utah for soils other than specified soil conditions.
2. Additional materials required to achieve alternate foundation.
3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 DELIVERY TIMING

A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8 weeks from receipt of approved submittals and receipt of complete order information.

3.3 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

B. Field Light Level Accountability

1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
2. The contractor/manufacturer shall be responsible for conducting initial light level testing and an additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.
3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.

D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. ***Submit checklist below with submittal.***

Yes/ No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens, and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Lighting design showing glare along the boundary line in candela. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years' experience.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.

	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Utah, if required by owner.
	H	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system and entertainment packages (Football Only). They will also provide ten (10) references of customers currently using proposed system in the state of Utah.
	I	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels, and wire sizing, signed by a licensed Electrical Engineer in the state of Utah.
	J	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Utah.
	K	Project References	Manufacturer to provide a list of five (5) projects where the technology and specific fixture proposed for this project has been installed in the state of Utah. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	L	Product Information	Complete bill of material and current brochures/cut sheets for all products being provided.
	M	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
	O	Cost of Ownership	Document cost of ownership as defined in the specification. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included. All costs should be based on 25 Years
	P	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela from the field edge on a map of the surrounding area until 500 candela or less is achieved.

The information supplied herein shall be used for the purpose of complying with the specifications for Duchesne High School Football, Baseball, Softball. By signing below, I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ **Signature:** _____

Contact Name: _____ **Date:** _____/_____/____

Contractor: _____ **Signature:** _____

DIVISION 27 - COMMUNICATIONS

27 10 05	STRUCTURED CABLING
27 41 16	INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT
27 51 17	PRO AUDIO SYSTEMS
27 51 24	INTERCOM SYSTEMS
27 53 13	CLOCK SYSTEMS - WIRELESS

SECTION 271005 - STRUCTURED CABLING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 260534 – Conduit.

B. Section 26 0536 – Cable Tray.

B. Section 26 0537 – J-Hooks Support.

B. Section 26 0538 – Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install back boxes and conduit system to accessible ceiling spaces.

B. District to provide and install equipment and cabling.

END OF SECTION

SECTION 274116 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 260534 – Conduit.

B. Section 26 0538 – Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install back boxes and conduit system to accessible ceiling spaces.

B. District to provide and install equipment and cabling.

END OF SECTION

SECTION 275117 – PRO AUDIO SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Amplifier and control equipment.

B. Input equipment.

C. Reproducer equipment.

D. Sound system cable.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0537 - Boxes.

1.3 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.

1.4 SYSTEM DESCRIPTIONS

A. Pro sound system for voice and music in the following areas.
   1. Commons Area
   2. Gymnasium
   3. Fitness Rooms
   4. Band Rooms
   5. Choir Room
   6. Training Classroom
   7. Drama Room
   8. Weight Room
   9. Wrestling Room
   10. Auditorium

1.5 SUBMITTALS

A. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

B. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

C. 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.

D. Operation Data: Include instructions for adjusting, operating, and extending the system.

E. Maintenance Data: Include repair procedures and spare parts documentation.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

C. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.7 WARRANTY

A. Warranty the entire system for a minimum of one year from the date of system acceptance by the Owner. Component warranties shall be honored for the term established by the manufacturer, if greater than one year.

B. Activate all manufacturer's equipment warranties in Owner's name to commence on the date of acceptance. In the case of installer modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.

C. Replace defective materials and repair faulty workmanship within 72 hours of discovery at no cost to the Owner during the period of the warranty.

D. If, during the warranty period, any component is out of service for more than one week due to unavailability of parts or service, supply and install an identical new component. If an identical component is not available, substitute equivalent equipment, but only with approval of the Owner.

PART 2 - PRODUCTS

2.1 SUPPLIER / INSTALLERS

A. Pre-qualification of Sound Installers:
   1. Sound Installers desiring to be pre-qualified other than those shown below, shall submit the required qualification statement of Paragraph 2.1.B.
      a. Marshall Industries Inc.
         1) 3800 West 2100 South
         2) Salt Lake City, UT 84120
         3) (801) 266-2428
      b. Bids submitted by non-pre-qualified bidders will not be accepted.

B. Sound Installer's Qualifications:
   1. The work of this section will be contracted to a single firm, referred to as the Sound Installer for undivided responsibility.
   2. The Sound Installer must be experienced in the installation of professional sound systems and have completed within the past five years at least five sound system projects of a size and scope comparable to the project described herein.
   3. The Sound Installer shall have capabilities and in-house facilities for installation, shop fabrication and repair service of professional sound systems.
   4. The Sound Installer shall have on his full-time payroll at least one staff engineer having five years minimum experience as an audio engineer. In place of a qualified staff engineer, the Sound Installer may retain a consulting engineer to direct the project. Prior to bid acceptance, the qualifications of the consulting engineer shall be submitted for the approval of the Consultant. Said staff or consulting engineer shall:
      a. Provide all technical liaison between the Sound Installer and the Consultant.
      b. Represent the Sound Installer at meetings and conferences, and be present at the job site for final inspection/

c. Be responsible for supervision of all technical and engineering work required to execute the contract and, in particular, approve and sign all shop drawings.

5. Must be a dealer or distributor of equipment included in bid and provide documents from manufacturers stating such.
6. Outline the general scope of past project, normal staffing levels, and union status of shop and field installation personnel.
7. List a minimum of three (3) projects of similar scope successfully completed, indicating the location, type of system installed, total contract amount, date completed, and include persons and telephone number to contact.
8. Submit confirmation of current state or local contracting licenses, as required to perform the work under this section.

2.2 MANUFACTURERS

A. Assisted Listening

B. Audio Technica

C. Atlas Sound

D. Electro Voice

E. Shure

F. Middle Atlantic

G. BSS Audio

H. Panelcrafters

I. Soundcraft

J. Crown

K. Tascam

L. Rane

M. Extron

N. Substitutions: See Section 01 6000 - Product Requirements.

2.3 EQUIPMENT

A. Provide cable and equipment as specified in the Equipment List on the drawings.

B. Supply the latest model, available at the time of installation, of each piece of equipment.

C. Materials: Supply materials and equipment that shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all electrical requirements including junction boxes, floor boxes, ceiling loudspeaker enclosures, cable, conduit and power circuits and receptacles are in place as shown on the drawings.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Include the delivery, unloading, setting in place, fastening to walls, floors, ceiling, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required which is necessary to result in complete operational systems.

C. Physical Installation:
   1. Firmly secure all equipment in place unless requirements of portability dictate otherwise.
   2. Mount permanently and/or provide a mechanical index insuring precise alignment of the projected image of all optical projectors.
   3. Provide adequate fastenings and supports with a safety load factor of at least three.
   4. Secure plumb and square all boxes, equipment, etc.
   5. Given consideration, not only to operational efficiency, but also to overall aesthetic factors in the installation of equipment and cable.

D. Cable Installation:
   1. Mark all cables, regardless of length, with permanent, non-handwritten number of letter cable markers within six inches of both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings.
   2. Furnish screw-type terminal blocks, boards, strips, or connectors, for all cables which interface with equipment cabinets, cabinets, consoles, or equipment modules. Terminate wires terminating at screw-type terminals with crimp-on lugs. “Telephone-style” punch-down blocks are not acceptable for signal or data wiring.
   3. Group all cables according to the signals being carried. In order to reduce signal contamination, form separate groups for the following cables:
   4. As a general practice, run all power cables, control cables, and speaker cables on the left side of an equipment cabinet as viewed from the rear. Run all other cables on the right side of an equipment cabinet, as viewed from the rear.
   5. Cut all cables to the length dictated by the run. Provide the interconnecting cables with a service loop of appropriate length where needed.
   6. Install no cable with a bend radius less than that recommended by the cable manufacturer.
   7. Where plenum-rated cable is used, provide plenum-rated and approved tie-wraps and supports (Thomas & Betts # TYV525M, or approved equal).
   8. Use armored cable for outside speaker circuits.
   9. Provide protection for exposed cables where subject to damage.
   10. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

E. Wall Plate Connectors:
   1. Wall Plate Designation: Clearly label all wall mounted receptacle plates with alphanumeric identification of input type (i.e., mic, line, speaker, etc) and corresponding audio designation.

F. Grounding Procedures:
   1. In order to minimize problems resulting from improper grounding and to achieve maximum signal-to-noise ratios, adhere to the following grounding procedures:
      a. General: Because of the great number of possible variations in grounding systems, follow good engineering practice, as outlined above, and deviate from these practices only when necessary to minimize crosstalk and to maximize sign-to-noise ratios in the audio, video, and control systems.
      b. System Grounds: Establish a single primary “system ground” for the systems in each particular area. Connect all grounding conductors in that area to this primary system ground. Provide the system ground in the audio equipment cabinet for the area. The ground shall consist of a cooper bar of sufficient size to accommodate all secondary ground conductors.

c. Equipment Cabinet Ground:
    1) Connect the No. 6 insulated copper wire connected to the earth ground to the primary system ground busbar in the Equipment Cabinet.
    2) Bond a No. 12 TW stranded wire from the Equipment Cabinet frame to the primary system ground bus bar.
    3) Equipment Grounds: Grounding methods used will be dependent upon individual equipment interconnection of chassis ground, circuit common, and power supply common within the units. Provide ground method for equipment types as follows:
    4) Equipment having a 3-wire power cord with green wire of the power cord connected to chassis (Signal common is not internally connected to chassis): Make no connection from chassis ground to primary systems ground busbar in Equipment Cabinet.
    5) Equipment having a 3-wire power cord with green wire of the power cord connected to chassis: Make no connection from chassis ground to primary system busbar, but do make connection with 14 AWG insulated wire from circuit common to primary system ground busbar in Equipment Cabinet. Separate circuit common from chassis ground.
    6) Equipment having a 2-wire power cord, no green wire, neutral is not tied to chassis, and circuit common is tied to chassis: Make connection from chassis to primary system ground busbar using 14 AWG insulated wire.

d. Audio Cable Shields: Ground all audio cable shields at one point only. There are no exceptions. For inter- and intr-equipment cabinet wiring connect the shield at one end only. For ungrounded portable equipment, such as microphones, connect the shield at both ends but grounded at only one end.

G. Splice cable only in accessible junction boxes or at terminal block units.

H. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

I. Leave 18 inches excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

J. Leave 6 feet excess cable at each termination at system cabinet

K. Provide protection for exposed cables where subject to damage.

L. Use armored cable for outside speaker circuits.

M. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

N. Use suitable cable fittings and connectors.

O. Install equipment racks in location shown; arrange to provide adequate ventilation and access.

P. Ground and bond equipment and circuits in accordance with Section 26 0526.

3.3 FIELD QUALITY CONTROL

A. Provide the services of manufacturer's technical representative to prepare and start systems.
    1. Include making of final wiring connections, inspection and adjusting of completed installation, and systems demonstration.
    2. Certify that installation is complete and performs according to specified requirements.

B. Measure and record sound power levels at designated locations.

C. Initial Tests and Measurements:
   1. Before final adjusting and acceptance test are scheduled, perform system checkout. Furnish all required test equipment and perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. Include the following:
      a. Test all audio and control systems for compliance with the functional requirements and Performance Standards.
      b. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications.
      c. Prepare and maintain documentation of all performance tests, including numerical values of established equipment settings, for reference by the Consultant during the System Acceptance Tests. Submit final results with the Operations and Maintenance Manual.
      d. Install 1/8 " Brother or Kroy arrows as indicators for nominal operating positions of all rotary, slider, or switch controls available for operator adjustment. Provide multiple indicators, adequately distinguished, for controls having more than one nominal operating position.
      e. Follow Electronic Industries Association Standards RS 219 and RS 160 in performing these tests.
   2. Audio System:
      a. Loudspeaker-Line Impedance: Measure the impedance at 250 Hz, 1 kHz and 4 kHz and the resistance of each loudspeaker line leaving the sound equipment cabinet with the line disconnected from its normal driving source. Record on single line riser diagram.
      b. Hum and Noise Level:
         1) Measure the hum and noise levels of the overall system for each microphone input channel and line-level input channel.
         2) Adjust gain controls for optimum signal-to-noise ratio so that full amplifier output will be achieved with 0 dBm at a line-level input.
         3) Terminate line-level inputs with shielded resistors of 150 and 600 ohms, respectively, for these measurements.
         4) Disconnect the loudspeaker lines and terminate the power-amplifier outputs with power resistors for these measurements. The value of the load resistor shall be within 5% of the nominal load impedance of the amplifier under test. The power rating of the resistor shall equal the power rating of the amplifier.
      c. Frequency Response of the System:
         1) Measure the frequency response from input to every output.
         2) Installations with equalizers shall meet following performance parameters as measured in 1/3 octave bands. From 10 Hz to 2 kHz, flat within plus or minus 2 dB. Above 2 kHz, slope down along an approximate 3 dB per octave slope to 8 kHz.
         3) Programmable Equalizers: Provide necessary controller with full audio spectrum display for the adjustment of all programmable equalizers during system checkout. Do not provide any equalizer programmers with the systems.
      d. Uniformity of Coverage: Measure octave band of pink noise test signal, centered at 4 kHz, played through loudspeaker system. Record at least 8 locations in the audience area.
      e. Power-Output and Signal-Level Adjustment within System:
         1) Measure the electrical distortion of the overall system for each line-level input channel.
         2) Adjust gain control as for the tests specified herein.
         3) Apply a 1-kHz sine-wave signal from an oscillator having less than 0.5% total harmonic distortion at the input tested, at a level required to produce full amplifier output. Note that a pad with 150-ohm output impedance is required for driving the microphone-level input in accordance with the EIA standard.

4) Use a distortion analyzer to measure the output level and the total harmonic distortion of the amplification and control equipment. In the absence of a distortion analyzer, a high input impedance measuring device such as a DMM may be used to measure the output level. Lack of clipping or apparent deformation of a sine-wave input signal at the power-amplifier output, as seen on the oscilloscope, may serve as evidence that distortion of amplification and control equipment is within acceptable limits, subject to review by the Consultant.
5) Make all measurement with loads actually incurred in the system operation. Power-amplifier loads shall be power resistors equal to the nominal load impedance of the output terminals used in the system.

f. Loudspeaker Polarity
1) Perform polarity checks of loudspeaker lines by means of a polarity tester of use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.
2) Test polarity of the loudspeakers using a sine-wave test signal warbled about 500 Hz. The listener shall be located on axis of the loudspeaker. Switch the loudspeakers from nominally in polarity to nominally out of polarity with respect to the selected loudspeaker. With the loudspeakers in proper polarity, the quality and clarity of the music or speech should be greater, and the warble test signal should clearly come to the surrounding space from the loudspeaker.

g. Freedom From Parasitic Oscillation and Radio-Frequency Pickup:
1) With systems set up for each mode of operation specified in the functional requirements, check to ensure that all systems are free from spurious oscillation and radio-frequency pickup, both in the absence of any audio input signal and also when the system is driven to full output at 100 Hz.
2) Employ an oscilloscope having at least 5 MHZ bandwidth for these checks.
3) Apply show sine-wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power-amplifier output voltage to each system. Listen carefully for buzzes, rattles and objectionable distortion.
4) Correct any causes of these defects unless the cause is clearly from other than the sound amplification system's equipment and installation, in which case bring the cause to the attention of the Consultant.

h. Audio Test Signal Paths: Verify operation from all source inputs (for microphones, audio tape units, video tape units, etc.) Through all distribution amplifiers, mixers switchers, etc., to all signal destinations.

3.4 ADJUSTING

A. Adjust transformer taps for appropriate sound level.

B. Adjust devices and wall plates to be flush and level.

C. If the need for further adjustments becomes evident during the demonstration and testing, continue work until the installation operates properly. Continued work shall include, but not be limited to, changes to or installation of resistive pads, readjustment of loud speaker aiming, adjustment of system equalizers, programming changes to the control system, if in the judgement of the Consultant, these adjustments are required.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of 8 hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.
   5. Provide two copies of video recorded operation and maintenance instructions (format as requested by owner) as described above. Demonstrate actual maintenance procedures for all equipment and systems installed. Demonstrate operation of all systems, including initial start-up.

3.6 MAINTENANCE

A. Provide service and maintenance of public address system for one year from Date of Substantial Completion.

END OF SECTION

SECTION 275124 - INTERCOM SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 260534 – Conduit.

B. Section 26 0538 – Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install back boxes and conduit system to accessible ceiling spaces.

B. District to provide and install equipment and cabling.

END OF SECTION

275313 CLOCK SYSTEMS - WIRELESS

GENERAL - PART I

1.1 General Requirements & Scope

A. Furnish and install a complete new wireless clock system using Sapling, Inc. wireless system.

B. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of Sapling, Inc. The specifying authority must approve any alternate system.

C. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least ten (10) days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six (6) installations of the identical system proposed which have been in operation for a period of two (2) year.

D. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the “precise functional equivalent” shall result in the removal of the alternate system at the contractor’s expense.

1.2 Related Documents

A. Drawings and general provisions of Contract apply to this Section.

B. Requirements of the following apply to this Section:
   1. Basic Electrical Requirements.
   2. Basic Electrical Materials and Methods

1.3 Summary

A. This Section addresses the needs and requirements of the wireless clock system. It includes requirements for the wireless clock system components including, but not limited to, the following:
   1. Wireless Transceiver.
   2. Secondary Analog Clock.

1.4 System Description

A. General: Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating wireless clock system.

1.5 Submittals

A. General: Submit the following in accordance with Conditions of Contract Sections:
   1. Submit equipment prints, full electronic wiring diagrams and specifications sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification sheets shall be submitted on all items.
      a. Shop drawings detailing wireless clock.
   2. Wiring diagrams, detailing wiring for power, signal, and control.
   3. Submit wiring diagrams showing typical connections for all equipment.
   4. Submit a certificate of completion of installation and service training.

1.6 Quality Assurance

A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least three (3) years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

C. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

D. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:
   1. Article 250, Grounding.
   2. Article 300, Part A. Wiring Method.
   3. Article 310, Conductors for General Wiring.
   4. Article 725, Remote Control, Signaling Circuits.
   5. Article 800, Communication Systems.

E. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers.

F. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must provide written proof that the agency is adequately staffed with factory-trained technicians for all of the specified equipment. The agency must have established business for and currently be providing all services for the equipment.

G. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. Maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident. Additionally, all manufacturer supplied products must be covered by three (3) year (parts only) limited warranty from the date of acceptance. The warranty period shall begin on the date of purchase by the owner/engineer.

H. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

I. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

J. The contractor is responsible for all cost associated with proper installation, termination, configuration, programming, impedance and load matching of all system components.

K. The contractor shall provide all necessary masonry, covering, patching, and painting work in order to render any residue of the existing central equipment invisible. All finished surfaces shall be chosen in consultation with the Owner, to assure that the Owner's aesthetic preferences have been adhered to.

1.7 Delivery, Storage, and Handling

A. Deliver products in factory boxes. Store in clean, dry space in original boxes. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.8 In-service Training

A. The contractor shall provide training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

PRODUCTS - PART II

2.1 Manufacturers

A. The manufacturer shall be:
   1. Sapling, Inc.
      1633 Republic Road
      Huntingdon Valley, PA 19006
      Phone: 215.322.6063
      Fax: 215.322.8498
      Web: www.Sapling-Inc.com

B. The new wireless clock systems shall each be a Sapling Wireless Clock System.

C. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.

D. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release the contractor from strict compliance with the requirements of this specification.

E. The Contractor for this work shall be held to have read all of the Bidding Requirements, the General Requirements, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.

F. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

G. In preparing the bid, the bidder should consider the following:
   1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.

H. Any prior approval of an alternate system does not automatically exempt the supplier from the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

I. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to bid date. Submission of an alternate shall contain an original draft point by point comparison of the submitted product relative to the requirements of this specification, engineering drawings of the system, and specification sheets covering all components of the system as well as all items of Section 1 “SUBMITTALS”. The system and equipment drawings and specification sheet shall meet all items of the specification.

J. Proposed alternate equipment shall be accompanied by a letter from the manufacturer clearly stating that they have read the specifications, have listed differences between their product and the specified product, and commit to meet or exceed the specified requirements herein.

K. All proposed alternate systems must comply with Section 2.1, letters H and I above. Submissions failing to comply with the aforementioned requirement shall be deemed as non-compliant.

2.2 System Requirements

A. Wireless analog and/or digital clock system with interface capability to GPS, network, internet and existing systems such as: 58 minute, 59 minute, National Time & Rauland sync-wire, once a day reset, 2-wire digital communication and RS485 communication.

2.3 System

A. The system can work as a stand-alone system or in conjunction with an existing wired system and the system shall have interface capability to GPS, network, Internet and existing systems such as: 58 minute, 59 minute, National Time & Rauland sync-wire, once a day reset, 2-wire digital communication and RS485 communication.

B. The system shall be designed to work in an environment where cabling options are not available. The system shall be capable of working in 915-928 MHz frequency-hopping technology. The system shall be capable of automatic transmission of data along 51 alternating frequencies that allows for an enhanced signal, even if there is interference in one of the frequencies.

C. Each clock in the system shall be capable of receiving and transmitting the wireless signal which allows it to be used as a repeater while boosting the data stream and sending along the system. With this dual capability there shall be no limit on the number of clocks that can be used in the installation. The clock shall be designed to automatically work together without interference with each other. The system shall be capable of increasing the quality of the signal while increasing the quantity of the clocks.

D. The analog clocks shall be capable of working in one (1) of the following options
   1. Two (2) D cell batteries; the clock receives and transmits time every four (4) hours.

E. The analog clock shall include automatic digital calibration for time base to minimize deviation from each other.

F. The analog clock shall have a built-in close-loop system that will allow the clock to detect the position of the hands and bring the clock to the right time even if the clock were manually or forcefully altered.

G. The analog clock shall have the capability for diagnostic function that will allow the user to view the quality of the signal, how long since the last time the clock received a signal, as well as functional tests of the electronics and the gears.

H. The system shall operate in a license-free frequency range where no license is required.

2.4 FCC Approval

A. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
   1. Reorient or relocate the receiving antenna.
   2. Increase the separation between the equipment and receiver.

3. Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician.

2.5 Product

A. Transmitter/Transceiver

1. The Master Clock / Transmitter shall be the Sapling STR 2000 Transceiver. The transmitter shall be capable of transmitting data to the SAL wireless analog clock and the SBL wireless digital clock. The transmitter shall be capable of receiving a signal from an atomic clock web site via the Internet. The transmitter will be capable of receiving signals from all Sapling Master Clocks via RS485, as well as 59 minute correction, 58 minute correction, National Time and Rauland, and Dukane. The transmitter shall have the capability of transferring a wired system into a wireless system. The transmitter shall have a programmable auxiliary relay and shall be programmed anywhere from 1—99 seconds. Upon utilization of the relay, the transmitter will be capable of interfacing with a once a day closure or interfacing with intercom systems. The transmitter shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main transmitter. The time base shall be temperature controlled allowing calibration of the time base during temperature changes. The transmitter will have two (2) switches for operation of the menu system. The transmitter shall be capable of interfacing with the SAM Series analog clock via the Converter Box, and the SRM Series analog clock and SBD 1000 digital clock via RS485. The transmitter shall utilize 915–928 MHz frequency–hopping technology. The transmitter shall be FCC compliant, part 15 Section 15,247.

B. Analog Clock

1. The secondary clock shall be Sapling SAL Series wireless clock. The clock will be capable of receiving a signal from multiple clocks. The clock shall receive and transmit with 915–928 MHz frequency–hopping technology. The clock is to be capable of transmitting the time simultaneously without interfering with each other. The clocks shall include automatic calibration, as well as a diagnostic function that allows the user to view the quality of the signal, the last time the clock received a correction signal, a gearbox test and a comprehensive analysis of the entire clock. The clock shall have a maximum correction time of five (5) minutes. It shall be designed to be used with the Sapling Transceiver or the Sapling Repeater, which can be regulated via Sapling wireless communication protocol. Upon receipt of the wireless signal, the clock will immediately self–correct. The clock shall have a semi–flush smooth surface ABS case. The dial is to be made of durable polystyrene material. The crystal is to be shatterproof, side molded polycarbonate. Glass and visible molding marks are unacceptable. The clock shall have black hour and minute hands as well as a red second hand. The clock shall be FCC compliant, part 15 Section 15,247.

EXECUTION - PART III

3.1 Examination

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the wireless clock system.
B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 Installation

A. General:
   1. Install system in accordance with applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:
   1. Conceal wiring except in unfinished spaces.
   2. All new wiring on this project must be properly rated for the application.
   3. Cable to the new devices at new locations shall be installed in a neat and workmanlike manner, following the standard procedures used in the electrical contracting trade.
   4. Exposed wiring will not be permitted under any circumstances on this project.
   5. Any wiring, which is considered sloppy by the Engineer, shall be strictly unacceptable.
   6. Upon installation completion, a room-by-room test shall be conducted for every device in the system. A technician shall perform the test after school hours, and repairs shall be performed as needed at no cost to the Owner to any devices, which do not function correctly, including cable. A written room-by-room report following testing and repairs shall be prepared and submitted to the Engineer.

3.3 Field Quality Control

A. Contractor Field Service:
   1. Provide services of a service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection.
   1. Make observations to verify that units and controls are properly labeled.

C. Testing:
   1. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at the Contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3.4 Commissioning

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven (7) days advance notice.

3.5 Cleaning and Protection

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 16 761

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 13 00	ACCESS CONTROL
28 23 00	VIDEO SURVEILLANCE
28 31 00	FIRE DETECTION AND ALARM

SECTION 281300 - ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 260534 – Conduit.

B. Section 26 0538 – Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install back boxes and conduit system to accessible ceiling spaces.

B. Stub conduits into door frames.

C. District to provide and install equipment and cabling.

END OF SECTION

SECTION 28 2300 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 260534 – Conduit.

B. Section 26 0538 – Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install back boxes and conduit system to accessible ceiling spaces.

B. District to provide and install equipment and cabling.

END OF SECTION

SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 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.

1.2 SYSTEM DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The system shall be an active/interrogative type system where each device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the associated initiating device and notification appliance circuit wiring is functional. Loss of such a signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

C. Operation of manual station or automatic activation of any smoke detector or heat detector shall-
   1. Cause system evacuation horns to sound and lamps to flash.
   2. The LCD display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises.
   3. All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.
   4. Initiate off-site alarm notification.
   5. Release magnetic door holders.
   6. Initiate shut down of mechanical units with air flow in excess of 2000cfm.
   7. Initiate closure of all fire/smoke dampers.

1.3 RELATED REQUIREMENTS

A. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

B. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.4 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).

B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).

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

D. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.

E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2012.

F. UL 1635 - Digital Alarm Communicator System Units

G. UL 1971 - Signaling Devices for the Hearing-Impaired.

H. UL 864 - Control Units for Fire Protective Signaling Systems.

I. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.

J. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

K. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.

L. UL UUJS Local, Auxiliary, Remote Station and Proprietary Protective Signaling Services.

1.5 SUBMITTALS

A. See General Conditions - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

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. Evidence of instructor qualifications; training lesson plan outline.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. 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.

H. Operating and Maintenance Data: 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.

I. Project Record Documents: 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.

J. 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. Maintenance contract.

K. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
2. In addition to the items in quantities indicated in PART 2, furnish the following:
   a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   b. One copy, on CD-ROM, of all software not resident in read-only-memory.

1.6 QUALITY ASSURANCE

A. 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.

B. 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.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

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.

1.7 WARRANTY

A. 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.

B. 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

2.1 MANUFACTURERS

A. Fire Alarm Control Units: Products of the following are acceptable:
   1. Honeywell Security & Fire Solutions/Fire Control Instruments, Inc
      a. UL certified UUJS Local, Auxiliary, Remote Station and Proprietary Protective Signaling Services.
      b. Authorized Platinum Distributer.
      c. Installer:
         1) Nelson Fire Systems UUJS – S25069
   2. Provide all control units made by the same manufacturer.

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: Not permitted.
   1. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards for Accessible Design.
      b. The requirements of the State Fire Marshal.
      c. The requirements of the local authority having jurisdiction.
      d. Applicable local codes.
      e. The contract documents (drawings and specifications).
      f. NFPA 101.
      g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
   5. Master Control Unit (Panel): New, located as shown on drawings.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By remote supervising station.
   2. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 data lines.

C. 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.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3 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. 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 air handlers indicated.

2.4 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. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit:
   1. The main FACP Central Console shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: addressable detectors, annunciators, addressable modules, and other system controlled devices.
   2. The main FACP and Central Console shall perform the following functions:
      a. Supervise and monitor all detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
      b. Supervise all notification circuits throughout the facility.
      c. Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminal, panel display, and annunciators.
   3. System Capacity and General Operation
      a. The control panel shall provide, or be capable of expansion to 150% of intelligent/addressable devices and annunciation points indicated on drawings.
      b. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alpha-numeric keypad for Field Programming and Control of the Fire Alarm System.
      c. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.

d. The system shall include emergency evacuation signal utilizing intelligence such that loss of operation by the main FACP will not result in the loss of evacuation signal throughout the balance of the building.
e. The main communication bus (options bus) shall be capable of Class A or Class B configuration with a total bus length of 5,900 feet (1,798 m).

4. Display
   a. The System Display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
   b. The System Display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), which will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM; SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.
   c. The System Display shall provide a touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels will be accessible through the Display Interface Assembly to prevent unauthorized System control or programming.
   d. The System Display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE
5. Serial Interface Board
   a. The Serial Interface Board shall provide the EIA-232 interface between the Fire Alarm Control Panel and the UL Listed Electronic Data Processing (EDP) Peripherals.
   b. The Serial Interface Board shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
   c. The Serial Interface Board shall provide one EIA-485 port for the serial connection of the optional Annunciator and Control Subsystem components.
6. Enclosures:
   a. The control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   b. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left-hand side.
7. Power Supply:
   a. The Main Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP plus 25% spare capacity for future expansion.
   b. It shall provide meters to indicate battery voltage and charging current.
8. Operators Terminal:
   a. Provide the following functions in addition to any other functions required for the system.
      1) Acknowledge (ACK/STEP) Switch:
         (a) Signal Silence Switch.
         (b) Activation of the Signal Silence Switch shall cause all programmed Alarm Indicating Appliances and relays to return to the normal condition after an alarm activation. The selection of indicating circuits and relays which are silence-able by this switch shall be fully field programmable within the confines of all applicable standards.
      2) System Reset Switch.
         (a) Activation of the System Reset Switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

3) System Test Switch.
(a) Activation of the System Test Switch shall initiate an automatic test of all Addressable detectors in the system. The System Test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the Fire Alarm Control Panel. The Fire Alarm Control Panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the System Liquid Crystal Display, as well as on any CRTs or printers in the System.
4) Lamp Test Switch.

9. Field Programming
   a. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
   b. All programming shall be accomplished through the standard FACP keyboard or through the Video Display Terminal.
10. Off-Site Alarm Notification System
   a. Provide telephone line connection from telephone terminal board to fire alarm control panel.
   b. Provide dialer device to notify off-site personnel of alarm or abnormal conditions.
   c. Connect to fire alarm control panel so specified conditions initiate off-site call. Use one alarm code for alarm and second code for supervisory/trouble alarm.
11. Audible Horn Alarm Annunciation -
   a. Provide separate and distinct alarm signals for alarm and trouble conditions.
   b. Alarm signal shall also operate strobe lights, if specified.
   c. Provide alarm silence switches at control panel.
   d. Trouble alarm shall be horn integral to control panel.
   e. Supervisory alarm may be same audible alarm as trouble alarm, but with separate visual annunciation.

D. Initiating Devices:
1. Duct Detector Housing
   a. Provide smoke detector duct housing assemblies to mount an addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.
2. Addressable Smoke Detectors
   a. Flush mounted, addressable photoelectric
   b. UL listed compatible with the fire alarm control panel.
   c. Shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on solid. The LED shall flash at a 1/sec rate if the chamber is out of calibration range. The detector may be reset by actuating the control panel reset switch.
3. Addressable Fixed Temperature-ROR Heat Detector
   a. Addressable combination fixed temperature / rate-of-rise.
   b. Nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F(9°C) per minute.
   c. Rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
4. Detector Bases
   a. Flush mounted detector bases shall contain no electronics and support all flush series detector types.

5. Manual Station
    a. Addressable double action, single stage
    b. Polycarbonate construction with internal toggle switch.
    c. Finished in red with silver "PULL IN CASE OF FIRE" lettering
    d. Suitable for mounting on North American 2 2 (64mm) deep 1-gang boxes and 1 2 (38mm) deep 4 square boxes with 1-gang covers.

E. Notification Appliances:
1. Low Profile Horn-Strobes
    a. Audible output of 92 dBA at 10 ft. when measured in reverberation room per UL-464.
    b. Integrally mounted flashing light unit with block letters 'FIRE'. Multi-candela with field-selectable settings of 15cd, 30cd, 60cd, 75cd & 110cd, and flash rate between one and three Hertz. All units shall flash in synchronization with each other.
    c. The horn shall have a selectable steady or synchronized temporal output.
    d. In and out screw terminals shall be provided for wiring.
    e. Low profile horn/strobes shall mount in a North American 1-gang box.
2. Low Profile Strobes
    a. Provide low profile wall mounted strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a North American 1-gang box.

F. Initiation & Control Modules
1. Relay Module
    a. Provide addressable control relay circuit modules as required. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Spare Parts
1. Provide indicated quantity of spare parts:
    a. Horn/stobes - 2
    b. Strobes - 2
    c. Pull Stations - 1
    d. Smoke Detectors - 2
    e. Heat Detectors - 1

I. Batteries
1. Shall be 12 volt, Gell-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

J. Locks and Keys: Deliver keys to Owner.

K. 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

3.1 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. Install wiring in raceway. Minimum raceway size shall be 3/4 inch. Fire alarm system conductors from different zones may be combined in common conduit. Make certain that raceway size and wire quantity, size, and type is suitable for equipment supplied and is within NEC standards.

D. Label pull and junction boxes "FIRE ALARM" with red indelible ink.

E. Loop wires through each device on zone for proper supervision. Tee-taps not permitted.

F. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy.

G. Protect conductors from cuts, abrasion and other damage during construction.

H. Minimum conductor size shall be 14 AWG unless otherwise specified.

I. Do not install ceiling mounted detectors within 3 feet of air discharge grills. Coordinate with other trades as required.

J. Post copy of wire identification list inside fire alarm panel door or other area accessible to fire alarm service personnel.

K. Provide duct smoke detectors for all mechanical units with air flow in excess of 2000 cfm and tie into fire alarm control panel. Provide fan shut down circuit and associated control equipment for all required mechanical units.

L. Install conductors and make connections to elevator controller for elevator recall as required.

M. Install conductors and make connections to all, water flow switches, valve tamper switches, and door holding devices.

N. Install conductors and make connections to all fire/smoke dampers. Refer to mechanical drawings for exact number and locations.

O. Obtain Owner's approval of locations of devices, before installation.

P. Install instruction cards and labels.

3.2 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.

3.3 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. 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.
   2. Refresher Training: 1 session post-occupancy.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 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. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.5 MAINTENANCE

A. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

B. 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.

C. 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 at no extra cost to Owner.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. 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.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION

DIVISION 31 - EARTHWORK

31 07 00	GENERAL SITE REQUIREMENTS
31 10 00	SITE CLEARING
31 20 00	EARTH MOVING
31 50 00	EXCAVATION SUPPORT AND PROTECTION

SECTION 31 07 00
GENERAL SITE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but Not Limited to
   1. General procedures and requirements for Site Work.

PART 2 – PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Site Verification Of Conditions
   1. 48 hours minimum prior to performing any work on site, contact Dig Line to arrange for utility location services.
   2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
   3. Perform investigative excavating 5 days minimum in advance of performing any excavation or underground work.
   4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.
   5. Notify Owner of utilities a minimum of 48 hours prior to an work taking place.
   6. Any work required within public Right-of-Ways will require encroachment permit from entity with jurisdiction.

3.2 PREPARATION

A. Protection
   1. Spillage:
      a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
      b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
   2. Dust Control:
      a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
      b. Correct or repair damage caused by dust.
   3. Erosion Control:
      a. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.
      b. Develop, install, and maintain an erosion control plan if required by law.
      c. Repair and correct damage caused by erosion.
   4. Existing Plants and Features: Do not damage tops, trunks, and roots of existing trees and shrubs on site which are intended to remain. Do not use heavy equipment within branch spread. Interfering branches may be removed only with permission of Architect. Do not damage other plants and features which are to remain.
   5. Protect site from fire caused by welding, cutting, smoking, or other sources of ignition.

B. If specified precautions are not taken or corrections and repairs made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of the Work.

3.3 REPAIR / RESTORATION

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults which require adjustment.

3.4 FIELD QUALITY CONTROL

A. Notify Architect 48 hours prior to performing excavation or fill work.

B. If work has been interrupted by weather, scheduling, or other reason, notify Architect 24 hours minimum prior to intended resumption of grading or compacting.

C. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils which have been exposed to adverse weather conditions.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on demolition plan.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Removing asphalt and concrete walks, curb and gutter and paving
   5. Removing above and below grade site improvements.
   6. Disconnecting, capping or sealing, abandoning site utilities in place, and removing site utilities.
   7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security, protection facilities, and temporary erosion and sedimentation control procedures.
   2. Division 02 Section "Selective Site Demolition" for demolition of buildings, structures, and site improvements.
   3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control Drawings, a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent**.**

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 21, Division 22, Division 26, Division 27, and Division 28 Sections covering site utilities.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within tree protection zone.
   5. Remove tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 120 inches.
   2. Dispose of excess topsoil as specified for waste material disposal.
   3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. Refer to project plans for improvements to be abandoned in place.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

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SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to the recommendations of Geotechnical Engineering Study for “Duchesne High School”, 155 West Main Street, Duchesne, Utah Prepared by Earthtec Engineering, dated February 5, 2020, Earthtec Project No. 199085, included in Appendix.

1.2 SUMMARY

A. This Section includes the following:
1. Preparation of subgrade for building slabs, walks, pavements, Artificial Turf Football Fields, Tracks, Baseball and Softball Diamonds, Tennis Courts.
2. Preparing sub-grades for, pavements, drains, and artificial turf.
3. Backfilling of trenches within the contract limit lines, including but not limited to docks, planters, and walks adjacent to building.
4. Footings and foundation backfill.
5. Concrete and Earth Retaining Wall.
6. Drainage course for football field underdrain system
7. Subbase course for artificial turf and pavements.
8. Base course for asphalt paving and artificial turf
9. Subsurface drainage backfill for trenches and flat panel drains.
10. Excavating and backfilling for utility trenches.
11. Excavating and backfilling trenches for buried electrical utilities and pits for buried utility structures.

B. Related Sections include the following:
1. Division 01 Section “Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
4. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-grade and below-grade improvements and utilities.
5. Division 32 Section "Finish Grading and Soil Preparation” and “Sodding” for finish grading, including preparing and placing topsoil and planting soil for lawns.
6. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the work.
   2. Bulk Excavation: Excavation more than 10-feet in width and more than 30-feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cubic yard for bulk excavation or 3/4 cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090-lbf and stick-crowd force of not less than 18,650-lbf; measured according to SAE J-1179.
   2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Each type of plastic warning tape.
   2. Geotextile.
   3. Controlled low-strength material, including design mixture.

B. Samples: 12-by-12-inch Sample of sub-drainage and other geotextiles used.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D698 or ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.

D. Blasting Plan: For record purposes and for approval of authorities having jurisdiction.

E. Seismic Survey Report: For record purposes; from seismic survey agency.

F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.5 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
   1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Native rock crushed to meet the above requirements and free from significant porosity may also be used as satisfactory soils.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: 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 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered / Structural Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 4-inch maximum particle size,

at least 90 percent passing a 1-1/2-inch sieve, maximum 30 percent passing 3/4-inch sieve, not more than 15 percent passing a No. 200 sieve, a maximum Liquid Limit of fines of 35 and a maximum Plastic Index of 15.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 3/4-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed or crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Non-woven needle-punched geotextile, manufactured in the USA for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made in the USA from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
1. Portland Cement: ASTM C 150, Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch to 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material made in the USA with the following physical properties:
1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.

2. Compressive Strength: 80 psi , when tested according to ASTM C 495.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured in the USA for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured in the USA for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows when required by utility purveyor:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction and from architect and owner before bringing explosives to Project site or using explosives on Project site.
1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 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 outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches 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 beneath bottom of concrete slabs on grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or vehicle with similar unit axel weight.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 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.

3.10 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.

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, dampproofing, 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, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 12 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 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. Place backfill and fill soil materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Reduce loose depths as needed to achieve required compactions.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:
1. Under structures, building slabs, steps, and pavements, scarify and 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 85 percent if in landscaping areas or 95 percent if under structures, pavements, or walks.
5. Under structure, buildings slabs, steps, pavements and walkways placed on five or more feet of fill scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch
   3. Pavements: Plus or minus 1/2 inch

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
   1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
   1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor].
   2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where called for on details and on plans.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase and base course to required crown elevations and cross-slope grades.
   4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
   5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557 where called for on project plans.

3.19 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
   1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 50 00
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.

1.3 PERFORMANCE REQUIREMENTS

A. Design**,** furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

A. Shop Drawings: For excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordinate first paragraph below with qualification requirements in Division 01 Section "Quality Requirements." Qualification Data: For qualified professional engineer.

D. Other Informational Submittals:
1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
    a. Note locations and capping depth of wells and well points.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
    a. Geotechnical report.
    b. Existing utilities and subsurface conditions.
    c. Proposed excavations.
    d. Proposed equipment.
    e. Monitoring of excavation support and protection system.
    f. Working area location and stability.

g. Coordination with waterproofing.
h. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's, Construction Manager's, and Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition and made in the USA.

2.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

F. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

G. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

2.3 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

2.4 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
   2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
   3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

PART 3 - EXECUTION - NOT USED

END OF SECTION

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DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16	ASPHALT PAVING
32 13 13	CONCRETE PAVING
32 13 73	CONCRETE PAVING JOINT SEALANT
32 18 10	SYNTHETIC TURF FIELD BASE AND DRAINAGE
32 18 13	SYNTHETIC GRASS SURFACING
32 31 13	CHAIN LINK FENCES AND GATES
32 84 23	UNDERGROUND SPRINKLERS
32 92 23	SODDING
32 93 00	PLANTS

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Asphalt surface treatments.
4. Pavement-marking paint.
5. Traffic-calming devices.

B. Related Sections:
1. Division 02 Section "Selective Site Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices and as defined in Division 1.

1.4 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum if used.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each paving fabric, 12 by 12 inches minimum.
2. Each type and color of preformed traffic-calming device.
3. Each pattern and color of imprinted asphalt and precut marking material.

E. Qualification Data: For qualified manufacturer and Installer.

F. Material Certificates: For each paving material, from manufacturer.

G. Material Test Reports: For each paving material.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide copy of manufactures experience for verification of qualifications.

B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of city and DOT for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

E. Preinstallation Conference: Conduct conference at Project site
   1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
      a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      b. Review condition of subgrade and preparatory work.
      c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
      d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 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. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. 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 and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. 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.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. 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 Cement: AC 20 per ASTM D 3381 for viscosity-graded material except use ductility at 39.2 deg. F., >5 for AC 20 and delete the loss on heating requirement on residue from “Thin-Film Oven Test”.

B. Prime Coat: Not required if paving is done within 48 hours of final compaction.

C. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 **AUXILIARY MATERIALS**

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type I Type II or III Type IV, hot-applied, single-component, polymer-modified bituminous sealant.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N, Type F, and Type S; colors complying with FS TT-P-1952.
1. Color: White, Yellow, Blue, and As indicated.

F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
1. Color: White, Yellow, Blue, and As indicated.

G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
1. Color: White, Yellow, Blue, and As indicated.

H. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
1. Color: White, Yellow, Blue, and As indicated.

I. Glass Beads: AASHTO M 247, Type 1.

J. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
1. Dowels: Galvanized steel, 3/4-inch diameter, 20-inch minimum length.

2.4 **MIXES**

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction**; designed** according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
1. Provide mixes with a history of satisfactory performance in geographical area where Project is located. Provide mix with the following characteristics:
    a. Number of compaction blows each end of specimen: 50.
    b. Satiability based on ASTM D5581: 1200 minimum.
    c. Flow in 0.01-inch units per ASTM D5581: 10-18.
    d. Voids in mineral aggregate VMA: 14.
    e. The percentage of bituminous material by weight added to aggregate will be between 4% and 7% of the weight of the bituminous mixture.

2. Surface Course: 3-inch minimum compacted thickness and as indicated on the drawings with aggregate meeting the following gradation table:

½ inch	100
No. 4	60-80
No. 16	28-42
No. 50	11-23
No. 200	3-7

B. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Verify that the road base has been properly compacted and is at the correct line, grade, and slope.

C. Verify that the road base thickness is as indicated on the project plans.

D. Verify that sufficient depth at curbs, walks, lips and other vertical edges is available to place the required thickness of compacted asphalt.

E. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or other vehicle with similar axel weight.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

F. Proceed with paving only after unsatisfactory conditions have been corrected.

G. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. 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.

E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Not used.

C. Prime Coat: Do not use if paving takes place not more than 48 hours after final compaction and grading of road bases. If paving must be delayed significantly, re-grade and re-compact road base or apply Prime Coat. Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 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.
   3. Remove and replace items damaged by overspray or clean affected surfaces as directed by architect at no additional cost to owner.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt surface course in single lift if design thickness is less than 3-inches. If design thickness is more than 3-inches, place in multiple lifts with a minimum thickness of 1.5-inches and a maximum thickness of 3-inches.
   2. Spread mix at minimum temperature of 250 deg F.
   3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

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."**.**
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of the laboratory Marshal Mix design density according to ASTM D 1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Place asphalt so that final compacted asphalt is even with lip of gutter on curbs that drain away from the curb and gutter (open face or depressed curb and gutter). Place asphalt so that final compacted asphalt is 1/4-inch above lip of gutter on curbs that carry water (slope of parking lot is towards the curb). In transition areas, use extra care to make sure that no ponds, bird baths, or depressions are left after paving.

G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the 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.

C. After paving is complete, pour water on paved areas and identify ponds, bird baths, and depressions. Identify the same at open face and transition sections of curb and gutter. Remove and replace asphalt, curb and gutter, road base, and or sub-base as necessary to fix ponds, bird baths, or depressions at no additional cost to owner.

3.9 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow curing.
   1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 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 7 days minimum days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

E. Color
   1. Yellow: Parking stalls and pedestrian crossings.
   2. Blue: Handicap insignia at appropriate stalls.
   3. Red: Fire lanes and no parking areas.
   4. White: Directional arrows.

3.11 WHEEL STOPS

A. 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.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726. Cores will also be measured for compacted thickness. The owner and architect may also direct additional cores to be taken at locations of their choosing to verify final pavement thickness.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
c. Coordinate the time and locations of all holes so that cores may be filled.

E. The contractor will replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 **DISPOSAL**

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Walkways.
   2. Concrete Paving,
   3. Curb and gutter,
   4. Concrete Pads
   5. Structures

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
   2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
   3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Samples: 10-lb sample of exposed aggregate.

D. Qualification Data: For manufacturer and testing agency.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.
   8. Joint fillers.

G. Field quality-control test reports.

H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Obtain Architect's approval of mockups before starting construction.
   4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
   5. Demolish and remove approved mockups from the site when directed by Architect.
   6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete producer.
   d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 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. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

E. Plain Steel Wire: ASTM A 82.

F. Deformed-Steel Wire: ASTM A 496.

G. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

H. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

I. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

J. 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" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
1. Portland Cement and as specified in Division 3 except that for exterior concrete, the minimum compressive strength is 4000 psi at 28 days.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/4 to 1 inch nominal.
2. Aggregate Source, Shape, and Color and as required by the architect.

D. Water: ASTM C 94/C 94M.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Products:
a. Monofilament Fibers:
1) Axim Concrete Technologies; Fibrasol IIP.
2) Euclid Chemical Company (The); Fiberstrand 100.
3) FORTA Corporation; Forta Mono.
4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
5) Metalcrete Industries; Polystrand 1000.
6) SI Concrete Systems; Fibermix Stealth.
b. Fibrillated Fibers:
1) Axim Concrete Technologies; Fibrasol F.
2) FORTA Corporation; Forta.
3) Euclid Chemical Company (The); Fiberstrand F.
4) Grace, W. R. & Co.--Conn.; Grace Fibers.
5) SI Concrete Systems; Fibermesh.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
1. Products:
a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edeco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, ChemRex Inc.; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.

l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation; Finishing Aid.
p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
1. Products:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoko; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
1. Products:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
b. Burke by Edoco; Resin Emulsion White.
c. ChemMasters; Safe-Cure 2000.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
g. Kaufman Products, Inc.; Thinfilm 450.
h. Lambert Corporation; Aqua Kure-White.
i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
j. Meadows, W. R., Inc.; 1200-White.
k. Symons Corporation; Resi-Chem White.
l. Tamms Industries, Inc.; Horncure 200-W.
m. Unitex; Hydro White.
n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Color stain: Match Architect's sample or as selected by Architect from manufacturer's full range of stains.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
1. Types I and II, non-load bearing and types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
1. Products:
a. Burke by Edeco; True Etch Surface Retarder.
b. ChemMasters; Exposee.
c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
d. Euclid Chemical Company (The); Surface Retarder S.
e. Kaufman Products, Inc.; Expose.
f. Metalcrete Industries; Surftard.
g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
h. Scofield, L. M. Company; Lithotex.
i. Sika Corporation, Inc.; Rugasol-S.
j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

G. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Products:
a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
b. Dayton Superior Corporation; Quartz Tuff.
c. Euclid Chemical Company (The); Surflex.
d. Lambert Corporation; Colorhard.
e. L&M Construction Chemicals, Inc.; Quartz Plate FF.
f. MBT Protection and Repair, ChemRex Inc.; Mastercron.
g. Metalcrete Industries; Floor Quartz.
h. Scofield, L. M. Company; Lithochrome Color Hardener.
i. Symons Corporation; Hard Top.
2. Color: Match Architect's sample or as selected by Architect from manufacturer's full range.

H. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.8 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or II or AASHTO M 248, Type N or F.
1. Color: White, Yellow, Blue. See Section 321216 for color locations.

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
1. Color: White, Yellow, Blue. See Section 321216 for color locations.

C. Glass Beads: AASHTO M 247, Type 1.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 4000 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45

3. Select slump limit from options in subparagraph below or revise to suit Project.
4. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 5-8 percent nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, plasticizing, and retarding admixture in concrete, as required, for placement and workability.
2. Specify admixtures as part of submittal. Verify that admixtures proposed do not adversely effect stained concrete and will not modify colors of stain.
3. Coordinate acceptability of admixtures with architect.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. where specified and approved in mix submittal.

H. Color Stain: Add stain to concrete per manufacturers recommendations and to meet color required by architect and owner on areas of stained concrete.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons or similar axel weight vehicle.

3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

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.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
   1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   2. Provide tie bars at sides of pavement strips where indicated.
   3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, but not more than 12-feet apart. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated.

Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. 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.

L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
4. Coordinate with architect the locations of each type of finish.

3.8 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
   1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
   2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
   4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.

B. Coordinate the locations of finishes with the architect and owner prior to placing concrete.

3.9 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 free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
   5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
   8. Joint Spacing: 3 inches.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.

10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mix placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

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SECTION 32 13 73
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
   2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
   3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance for a minimum of 5-years.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants, as determined by Architect.
   1. Use manufacturer’s standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer’s written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer’s written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
   3. When joint substrates are wet or covered with frost.
   4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multi-component Non-sag Urethane Sealant:
   1. Products:
      a. Sikaflex – 2c NS; Sika Corporation or approved equal (Sooneborn NP-2, Tremco 240, Pecora Dynatrol 2).
   2. Type and Grade: M (multi-component) and NS (non-sag).
   3. Class: 25.
   4. Additional Movement Capability: 50 percent movement in extension and 50 percent in compression for a total of 100 percent movement.
   5. Use Related to Exposure: NT (non-traffic) and T (Traffic).
   6. Uses Related to Joint Substrates: M, G, A, O, I.
   7. Applications: Exterior and interior joints and gaps in vertical and horizontal surfaces. Submerged or immersion grade applications also apply.

B. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
   1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
      a. Products:
         1) Pecora Corporation; Urexpan NR-300; Sikaflex 2c SL.

C. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
   1. Products:
      a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1; Sikaflex 1a.

D. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone.
      b. Dow Corning Corporation; 888.

E. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone SL.
      b. Dow Corning Corporation; 890-SL.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform

beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 32 18 10
SYNTHETIC TURF FIELD BASE AND DRAINAGE (ALTERNATE #1)

PART I – GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Repair and installation of synthetic turf drainage system.
2. Construction of a stable and permeable aggregate double layer drainage layer.
3. Grading of all stone layers.

B. RELATED SECTIONS

1. Section 321813 – Synthetic turf system

1.2 SUBMITTALS

A. Product data:
   1. Drainage Materials.

B. Sieve Analysis:
   1. Base Stone
   2. For Finishing Stone

C. Product Samples:
   1. Drainage Materials
   2. Base Stone
   3. Finishing Stone

D. Submit calculations for base stone and finishing stone showing structural stability, separation of both stones, permeability, and porosity of compacted stone.

1.3 QUALITY ASSURANCE

A. Sieve analysis of every 500 tons of stone shall be provided by the contractor to be reviewed on site by geotechnical and Civil Engineer.

B. Architect shall be on site and approve elevation, planarity and quality of work at the placement of sub-grade prior to placement of liner and placement of drainage course.

1. Pre-installation Conference: Conduct conference at project site prior to laying sheet liner.

1.4 WARRANTY

A. The Contractor shall submit Warranty which guarantees the materials in this section to be free from defects of materials and workmanship. The warranty shall guarantee the usability and playability of the synthetic turf system for its intended uses. The warranty shall be in effect for one (1) year period commencing with the date of Substantial Completion.
   1. The warranty submitted must have the following characteristics:
      a. Must provide full coverage for one (1) years from date of Substantial Completion,
      b. Must warrant materials and workmanship,

c. Must warrant that the materials installed will maintain their strength and integrity and permeability,
d. Must have a provision to either repair or replace such portion of the installed materials that are no longer serviceable to maintain a safe, serviceable and playable surface,
e. Must not limit to the amount of annual usage,

PART II – PRODUCTS

2.1 GEOTEXTILE FABRIC

A. Nonwoven geotextile fabric composed of polypropylene fibers with the following properties:
1. 0.53 lbs. Grab Tensile Strength
2. 50% Grab Tensile Elongation
3. 50 lbs. Trapezoid Tear Strength
4. 225 psi Mullen Burst Strength
5. 65 lbs Puncture Strength
6. 300 lbs. CBR Puncture Strength
7. 70 sieve Apparent Opening Size
8. 0.18 sec Permittivity
9. 70% Retained Strength UV Resistance at 500 hours
10. Minimum Weight - 4.8 oz/yd²
11. Thickness - 55 mils

B. Manufacturers that may be incorporated in the work include, but are not limited to, the following:
1. Mirifi 140N

2.2 STRIP DRAINS

A. Strip drains shall be a 12” wide and approximately 1” thick prefabricated ridged drainage core wrapped with geotextile filter fabric.

1. Manufacturers that may be incorporated in the work include, but are not limited to, the following:
a. Multi-Flow Drainage Systems

B. The collection system core shall be made of a high-density polyethylene. The core shall be constructed using interconnected corrugated pipes that define and provide the flow channels and structural integrity of the collection system. Perforations shall be evenly distributed on both faces of the core. The core of the collection system shall conform to the following physical property requirements.
a. Thickness, inches ASTM D-1777 1.0
b. Outflow Rate, gpm/ft* ASTM D-4716 29
c. Compressive Strength, psf ASTM D-1621
d. (modified sand method) 6000
e. Perforations / sq. ft. --- > 300 * At gradient = 0.1, pressure = 10 psi for 100 hours.

C. The collection system shall be wrapped with a non-woven geotextile.of a needle-punched construction consisting of long-chain polymeric fibers composed of polypropylene, polyethylene or polyamide. The fibers shall allow the passage of water as specified without displacement or deformation. The fabric shall be free of any chemical treatment or coating, which reduces permeability and it shall be inert to chemicals commonly found in soil.
1. The geotextile shall conform to the following minimum average roll values.
a. Weight ASTM D-3776 4.0
b. Tensile Strength ASTM D-4632 100
c. Elongation % ASTM D-4632 50

d. Puncture, lb ASTM D-751 50
e. Mullen Burst, psi ASTM D-3786 200
f. Trapezoidal Tear, lb ASTM D-4533 42
g. Coefficient of Permeability ASTM D-4491 .1 cm/sec
h. Flow Rate, gpm/ft2 ASTM D-4491 100
i. Permittivity, 1/sec ASTM D-4491 1.8
j. Apparent Opening Size ASTM D-4751 70 Max US Std Sieve Opening
k. Seam Strength, lb/ft ASTM D-4595
l. Fungus ASTM G-21 No Growth

2.3 AGGREGATE DRAINAGE LAYER

A. Aggregate drainage layer consists of a 4" thick base stone layer and a 2" thick finishing stone layer.
B. All drainage stone shall be mechanically fractured stone with elongated characteristics. Material shall be free from fines. Rounded sands or aggregates are not acceptable.
C. Drainage stone layers shall drain at 20" of rainfall per hour minimum. The following gradations are suggested, but may be modified based on the characteristics of the specific stone selection. to meet the stability requirements.

% PASSING

Sieves	Base Stone	Finishing Stone
1½" or 38mm	100	
1" or 25mm	95-100	
¾ or 19mm	80-100	
½" or 12.5mm	60-80	100
3/8" or 9.5mm	30-50	99.5
US #4 or 4.75mm	20-40	35.2
US #8 or 2.36mm	10-30	3.5
US #16 or 1.18mm	7-25	1.2
US #40 or 425mm	5-17	
US #200 or 75mm	0-4	

D. Restrictions, provide calculations:

1. To ensure structural stability: $D_{60}/D_{10} > 5$ and $1 < \frac{D^2_{30}}{D_{10} D_{60}} < 3$

Fragmentation must be 100%.

2. To ensure separation of both stones: $\frac{D_{85} \text{ of finishing stone}}{D_{15} \text{ of base stone}} > 2$

   and $3 < \frac{D_{50} \text{ of base stone}}{D_{50} \text{ of finishing stone}} < 6$

3. To ensure proper drainage: Permeability of base stone > 10 in/hr (7×10^{-3} cm/sec)

   Permeability of finishing stone > 10 in/hr (7×10^{-3} cm/sec)

   Porosity of both stones > 25%

   (Test with stone saturated and compacted to 95% Proctor.)

4. Depending on the type of rock present in the crushed stone mix, other mechanical characteristics might be necessary for approval.

"Dx" is the size of the sieve (in mm) that lets pass x% of the stone. For example, D_{60} is the size of the sieve that lets 60% of the stone pass. These sizes, for calculation purposes, may be obtained by interpolation on a semi-log graph of the sieve analysis.

Part III – EXECUTION

3.1 EXAMINATION

A. Examine the subgrade and verify that it is properly compacted and graded.

B. Proof roll with a 5 ton min. static tandem drum type roller and mark any soft spots.

C. Proceed only after unsatisfactory conditions have been repaired.

D. Representatives of the owner, architect, and contractor shall meet and examine the subgrade after the contractor has certified that the subgrade has been laser graded and is within tolerances. Once the subgrade has been approved, contractor to begin construction of the perimeter drainage and impermeable liner immediately to protect it from weather.

3.2 PERIMETER DRAIN

A. Excavate perimeter drainage trenches to the depth necessary to install pipes at the elevations shown on civil plans. Slope bottom of trench at the slope equal to the slope of the pipe.
   1. All loose debris shall be removed from the trenches.

3.3 GEOTEXTILE FABRIC

A. Place a geotextile fabric layer directly above the impermeable liner over the entire area including trenches.

B. Install in layered fashion similar to impermeable layer.

3.4 DRAINAGE SYSTEM

A. Strip Drains:
   1. Place strip drains directly on top of the geotextile fabric at 30' on center at a 45º angle. Secure every 15' with duct tape.
   2. Connect the ends of the strip drains to the perimeter collector drain pipe.

B. Perimeter Collector Drains
   1. Place and compact a minimum of 2" clean, drainable crushed stone aggregate at the bottom of the trench.
   2. Place a minimum of 4" clean, crushed aggregate on the sides of the pipe and a minimum of 6" on top of the pipe. Compacting in lifts as directed by the geotechnical engineer.

3.5 BASE STONE DRAINAGE LAYER

A. The crushed base stone must be laid without damaging or disturbing the soil bed, geo-textile liner or membrane, or the underlying strip drains. It is very important not to create any depressions in the sub-grade with heavy equipment. The specified stone or aggregate supplied must conform to the recommended specifications, as noted above. The finished crushed stone or aggregate base supplied must be stable and permeable. The stone shall be damp when transported to site and shall be kept damp during installation, to minimize segregation of the materials.

B. The grade of the base course shall not vary from the specified grade by more than ½" from design grade.

C. The base course must be compacted in both directions to attain a compaction rate of 95% standard, Proctor.

3.6 FINISHING STONE DRAINAGE LAYER

A. The final lift of aggregate layer should not be more than 2” deep.

B. The final lift material must be sloped 0.5% from the center longitudinal axis towards the sidelines unless otherwise specified.

C. The final grade must be compacted in both directions to attain a compaction rate of 95% standard, Proctor.

D. The final grade of the finishing stone shall not vary from the specified grade by more than 1/4" from design grade, nor by more than ¼" when measured under a 16 ft straightedge, in all directions. This tolerance is required over the entire repair area. Check the tolerance-to-grade by means of a 16’ straight edge and string once the stone is fine graded and compacted to proper density. Any areas outside of the tolerances shall be remedied by hand. Spread 3/8" granite chips and roll by hand until the area has been brought within tolerances. The turf installation company shall not commence work until the base has been tested for compaction, tolerance to grade, and porosity.

3.7 TESTING

A. The permeability of the stone course shall be checked per DIN 8035 part 7, (preferred), ASTM 2434 (Constant Head), or ASTM D3385 (Double Ring) testing methods. Test samples shall be taken at a minimum of one sample every 10,000 square feet.
B. All test results will be logged and documented by an independent testing agency.

C. Final planarity will be verified with a 16' straightedge over the entire playing surface.

D. When the Contractor has independently confirmed that he is in compliance with all the above listed requirements (planarity and elevation verified by a licensed Surveyor and compaction, gradation, and permeability verified by the specified tests), he shall notify the Owner's Representative to schedule a final inspection by the Synthetic Turf System Installer. Any deficiencies uncovered during this inspection must be remedied to the satisfaction of the Synthetic Turf System Installer before the base system will be considered acceptable.

END OF SECTION

SECTION 32 18 13
SYNTHETIC GRASS SURFACING (ALTERNATE #1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Synthetic grass surfacing and infill.

B. Edge anchoring and borders.

C. Correction of grades and subgrade.

D. Field graphics.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading.

B. Section 31 23 16 - Excavation.

C. Section 31 23 16.13 - Trenching.

D. Section 31 23 23 - Fill.

1.03 REFERENCE STANDARDS

A. ASTM C476 - Standard Specification for Grout for Masonry 2020.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012 (Reapproved 2021).

C. ASTM D1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings 2021.

D. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

E. ASTM D5823 - Standard Test Method for Tuft Height of Pile Floor Coverings 2019.

F. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards 2017.

G. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use 2021.

H. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes 2003 (Reapproved 2018).

I. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2021.

J. ASTM F2765 - Standard Specification for Total Lead Content in Synthetic Turf Fibers 2014 (Reapproved 2021).

K. ASTM STP322-1 - Field Testing of Soils, Chapter 1: Field Percolation Tests for Sanitary Engineering Application 1962.

L. CPSC Pub. No. 325 - Public Playground Safety Handbook 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. See Section 01 30 00 - Administrative Requirements - Administrative Requirements, for project meetings.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: For all manufactured surfacing products, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.

C. Shop Drawings: Carpet Roll: Show locations of seams and methods of seaming.
   1. Field Graphics: Include methods of seaming.

D. Samples: For each product for which color must be selected provide color chart showing full range of colors.

E. Samples: Provide the following prior to ordering material:
   1. Synthetic Grass carpet: Two 12 inch by 12 inch (305 mm by 305 mm) pieces.
   2. Infill material: Two 1 gallon bags for each type.
   3. Seamed synthetic grass carpet: Two 12 inch by 24 inch (305 mm by 610 mm) pieces seemed together for each seaming method indicated on drawings.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Data:
   1. For manufactured surfacing products, provide manufacturer's recommended maintenance instructions and list of repair products, with address and phone number of source of supply.
   2. For loose fill surfacing products, provide detailed re-ordering information to enable Owner to match installed material exactly.

1.06 QUALITY ASSURANCE

A. See section 01 40 00 - Quality Requirements, for procedures for testing, inspection, mock-ups, reports, certificates, use of reference standards.

B. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

C. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Surfacing installed in minimum 10 sites and been in successful service minimum 5 years.
   2. Manufacturer's Representative: Provide name, company name and address, and qualifications.

D. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 FIELD CONDITIONS

A. Ambient Conditions: Work under this section will cease when:
   1. Temperatures are below 55 degrees F.
   2. Humidity levels are above the adhesive manufacturer's requirements.
   3. Rain is imminent or falling.
   4. Surfaces are wet or damp.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals - Closeout Submittals, for additional warranty requirements.

B. Provide 8 year minimum warranty from the date of substantial completion for materials and installation covering:
   1. Excessive wear.
   2. Fiber tensile strength.
   3. Deterioration or fading from UV light.

PART 2 PRODUCTS

2.01 SYNTHETIC GRASS SURFACING

A. Manufacturers:
   1. Basis of Design: Fieldturf: Vertex.
   2. Shaw Sportsturf.
   3. Or approved equal.

B. Synthetic Grass Carpet: Dual fiber system with yarn fibers tufted through and adhered to a porous fiber backing.

1. Primary Blades:
    a. Fibers: Monofilament.
    b. Material: Polyethylene.
    c. Height: 2 1/4 inch, in compliance with ASTM D5823.
    d. Tuft Bind: 10 pounds-force, minimum, in compliance with ASTM D1335.
2. Secondary Blades:
    a. Fibers: Slit-Film.
    b. Material: Polyethylene.
    c. Height: 2 1/4 inch, in compliance with ASTM D5823.
    d. Tuft Bind: 10 pounds-force, minimum, in compliance with ASTM D1335.
3. Backing:
    a. First : Multi-layer of woven polyester treated with UV inhibitors.
    b. Second: Coating of polyurethane.
    c. Backing Weight: Primary - 8 ounces per square yard. Secondary - 20 ounces per square yard.
4. Permeability: Per manufacturer's recommended interval of water per hour, minimum.
5. Lead Content: 100 ppm, maximum, in compliance with ASTM F2765.
6. Roll: 15 feet (4.6 m) wide, minimum.
7. Noncombustible: Pass ASTM D2859 for flammability.
8. Field Graphics:
    a. Inlaid Marking: Synthetic grass of the same manufacturer in colors indicated on drawings. Field markings shall consist of 4" inlaid lines for each sport. Provide standard color selection samples for final color selection.
        1) Field - Alternating green colors.
        2) NFHS Football - White
        3) NFHS Soccer - Black
        4) End zones shall be colored zones with two color letters 18' tall.
        5) Center logo to be approximately 35' x 35', artwork to be provided by school. (Multi-colored)
        6) Coaches box - color as selected by Architect.
        7) 4" Wide white perimeter of football field.
        8) 7.5' wide colorized surround beyond white perimeter.

C. Synthetic Grass Infill: 3 pounds per square foot, minimum at:
1. 50 to 50 percent granule to synthetic sand.
2. Granule: SBR rubber, 10-20 mesh, free of metals, nonmetal fibers, and contaminants.
3. Sand: Silica, 30 to 40 mesh, free of silts, clays, and contaminants, roundness of subangular, minimum, per ASTM F1632.

D. G-max shall be < 165 without pad; <130 with pad.

2.02 MATERIALS

A. Edge Anchoring: Wood-polymer composite lumber complying with ASTM D6662; factory finished, free of sharp vertical edges, protruding elements, and trip hazards, capable of being secured to the border.
1. Minimum Edge Radius: 1/2 inch (13 mm).

B. Border: Permanent element surrounding edge anchoring, consisting of exterior walls:
1. Exterior Walls: As indicated on drawings.
2. Concrete Curb: As indicated on drawings.

C. Geotextile: Nonwoven polypropylene sheet.

2.03 ACCESSORIES

A. Fasteners, Synthetic Grass to Edging: 1/2 inch (13 mm) stainless steel staples, in compliance with ASTM F1667.

B. Fasteners, Edging to Border: Self drilling, stainless steel screws, in compliance with ASTM F1667.

C. Rebar: Number 4 rod.

D. Cementitious Grout: Fine, in compliance with ASTM C476.

PART 3 EXECUTION

3.01 PREPARATION

A. Lay out entire project perimeter as indicated on drawings prior to starting work.

B. Measure the location of all synthetic grass elements, including perimeter of existing synthetic grass surfacing, access and egress points, hard surfaces, walls, fences, and structures.

C. Verify location of underground utilities and facilities in the project area. Damage to underground utilities and facilities will be repaired at Contractor's expense.

3.02 SUBGRADE

A. Excavate unsuitable soils, see Section 31 23 16. Backfill with suitable material, see Section 31 23 23.

B. Correct irregularities to ensure that required depth of drainage layer can be installed, and elevation is in accordance with manufacturer's requirements.

C. Remove all obstructions that extend into the drainage layer within the composite nailer boards.

D. Perform rough and finish grading, see Section 31 22 00.

E. Shape to profile indicated on drawings and compact by proof rolling to a minimum 95 percent, in compliance with ASTM D698.

F. Flatness Tolerance: 1/2 inch in 10 feet (12 mm in 3 m), maximum.

G. Perform percolation test at the lowest elevation of the subgrade, in compliance with ASTM STP322-1.
   1. Report results to Architect.
   2. If percolation is less than 1 inch (25 mm) in a 3 hour period, do not proceed.

H. Verify that subgrades are at proper elevations and that smooth grading is complete.

3.03 TRENCHING AND BACKFILLING

A. Lay out trenching for entire drainage network prior to excavation, as indicated on drawings.

B. Excavate trenches in accordance with drawings.

C. Mirror base of trenches to finish grade.

D. Open trenches require the presence of daily site activity.

E. Repair deviations from plans after drainage pipe installation and prior to installing geotextile.

F. See Section 31 23 16.13 for trenching.

3.04 EDGE ANCHORING

A. Layout composite nailer boards. Approval of locations by Architect required prior to installing.

B. Install along full perimeter of synthetic grass.

C. Fasten to border with case hardened screws at 24 inch (610 mm) on center, minimum.

D. Set top of edging flush or recessed 1/2 inch (13 mm) below top of border, maximum.

3.05 BORDER

A. Verify that site furnishings and composite nailer boards located within project area are complete.

B. Install border walls according to design drawings.

3.06 SYNETHETIC GRASS

A. Carpet Rolls:
   1. Unroll all carpet in the same direction.
   2. Prevent seams from being located over impact mats.

3. Allow carpet to rest for at least 4 hours after unrolling and prior to seaming.
4. Smooth seams and edges, eliminate overlaps and gaps.

B. Seaming:
1. Cut: Straight, with a clean and smooth edge.
2. Method:
a. Sewing: 2 thread, bound seam stitch.

C. Securing: Staple carpet to edging 1 inch (25 mm) on center.

D. Field Graphics:
1. Applied Marking: Per manufacturer recommendations, in dimensions and color patterns indicated on drawings.
2. Inlaid Marking:
a. Shearing: Cut the synthetic grass through the backing, in dimensions and pattern indicated on drawings.
b. Inlay: Bond synthetic grass in colors indicated on drawings within sheared patterns.

3.07 INFILL

A. Apply during dry weather without signs of moisture on synthetic grass.

B. Thoroughly brush synthetic grass prior to infill installation.

C. Apply infill uniformly in multiple lifts, brush fibers between each application.

D. Measure depth to confirm accordance with plans.

3.08 CLEANING

A. Clean surrounding areas of excess construction materials, debris, and waste.

B. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.09 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Restore adjacent existing areas that have been damaged by work of this section.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Posts, rails, and frames.

B. Wire fabric.

C. Concrete.

D. Manual gates with related hardware.

E. Accessories.

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 2016a.

C. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework 2018.

D. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures 2018.

E. BHMA A156.3 - American National Standard for Exit Devices 2014.

F. CLFMI CLF-PM0610 - Product Manual 2017.

G. CLFMI CLF-SFR0111 - Security Fencing Recommendations 2014.

H. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric) 1990.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Line Posts: 1.9 inch (48 mm) diameter.

B. Corner and Terminal Posts: 2.38 inch (60 mm) diameter.

C. Fabric: 2 inch (51 mm) diamond mesh interwoven wire, 9 gage, 0.1483 inch (3.8 mm) thick, double knuckle at both selvages.

D. Fabric at Shop Enclosure Gates: Vinyl coated, black.

E. Tension Wire: 6 gauge, 0.1920 inch (4.9 mm) thick steel, single strand.

F. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

A. Corner Posts, Terminal Posts, Gate Posts:

1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, **heavy industrial duty** with a minimum yield strength of 50 ksi (345 MPa); zinc coating complying with ASTM F1043 and ASTM F1083.
2. Line Posts: Type I round in accordance with FS RR-F-191/1D.
3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.

B. Wire Fabric:
   1. ASTM A392 zinc coated steel chain link fabric.
   2. Mesh Size: 2 inches.
   3. Comply with CLFMI CLF-PM0610.

C. Selvage: Double Knuckled at both selvages.

D. Concrete:
   1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 3,000 psi strength at 28 days, 3 inch (75 mm) slump; nominal size aggregate.

2.03 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

B. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

C. Hinges: Finished to match fence components.
   1. All hinges shall be "bulldog" style hinges.

D. Latches: Finished to match fence components.
   1. Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.04 LIGHT-DUTY ARCHITECTURAL HARDWARE

A. Exit Devices: Aluminum, 36 inches (914 mm) wide.
   1. Performance Criteria: Comply with BHMA A156.3, Grade 1.
   2. Provide strike of type recommended by manufacturer for application indicated.
   3. Aluminum Finish: 628.
   4. Products:
      a. DAC Industries, Inc; Detex Exit Bar: www.dacindustries.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roller Assembly: Steel chassis assembly with permanently-lubricated and sealed roller bearings.
   1. Roller: Polymer casting, secured to shaft with nylon locknut.
   2. Finish: Galvanized.
   3. Products:
      a. DAC Industries, Inc; Stealth Cantilever Roller: www.dacindustries.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Caps: Aluminum alloy; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

C. Privacy Slats: Vinyl strips, sized to fit fabric weave.

2.06 FINISHES

A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot (530 g/sq m).

B. Components and Fabric at Shop Enclosure Gates: Vinyl coated over coating of 1.8 ounces per square foot galvanizing (over coating of 550 g/sq m galvanizing).

C. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

D. Accessories: Same finish as framing.

E. Color(s): To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb with concrete retaining wall, slab, or mow strip. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: ASTM F567.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

G. Provide top rail through line post tops and splice with 6 inch (150 mm) long rail sleeves.

H. Install center brace rail on corner gate leaves.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet (30 m) maximum, whichever is less.

K. Position bottom of fabric 2 inches (50 mm) above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches (380 mm) on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Do not attach the hinged side of gate to building wall; provide gate posts.

P. Install hardware and gate with fabric to match fence.

Q. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

R. Ground fence in accordance with Section 33 79 00.

S. Peen all bolts upon installation.

3.02 CLEANING

A. Leave immediate work area neat at end of each work day.

B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

C. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION

SECTION 32 84 23
UNDERGROUND SPRINKLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings, valves, sprinkler heads, emitters, bubblers, and accessories.

B. Control system.

1.02 REFERENCE STANDARDS

A. ASTM B32 - Standard Specification for Solder Metal 2020.

B. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

D. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.

E. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component and control system and wiring diagrams.

C. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, components, plant and landscaping features, site structures, schedule of fittings to be used.

D. Operation and Maintenance Data:
   1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
   2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

E. Record Documents: Record actual locations of all concealed components piping system and conduit.

F. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Sprinkler Heads: One of each type and size.
   3. Extra Valve Keys for Manual Valves: One.
   4. Extra Valve Box Keys: One.
   5. Extra Valve Marker Keys: One.
   6. Wrenches: One for each type head core and for removing and installing each type head.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

A. Hydraulic controlled underground irrigation system, with low point self drain.

B. Manufacturers:
   1. Rain Bird Sales, Inc: www.rainbird.com/#sle.
   2. Toro Company: www.toro.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PIPE MATERIALS

A. PVC Pipe: ASTM D2241; 200 psi (1.38 MPa) pressure rated upstream from controls, 160 psi (1.10 MPa) downstream; solvent welded sockets.

B. Fittings: Type and style of connection to match pipe.

C. Pipe Risers at Valves: 160 psi (1.10 MPa) PVC pipe.

D. Solvent Cement: ASTM D2564 for PVC pipe and fittings.

E. Sleeve Material: PVC.

2.03 OUTLETS

A. Outlets: Brass construction.

B. Rotary Type Sprinkler Head: Fixed type with screens; fully adjustable for flow and pressure; size as indicated; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.

C. Spray Type Sprinkler Head: Fixed surface head.

D. Emitter: Adjustable outlet, non-clogging, with two trickle tubes.

E. Quick Coupler: As per drawings.

2.04 VALVES

A. Gate Valves: Bronze construction non-rising stem.

B. Backflow Preventers: Iron body construction, double check valve type.

2.05 CONTROLS

A. Controller: As per drawings.

B. Controller Housing: As per drawings.

C. Valves: Hydraulic; normally open; hydraulic tubing, including required fittings and accessories.

D. Wire Conductors: Color coded.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify location of existing utilities.

B. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.

B. Layout and stake locations of system components.

C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

A. Trench to accommodate grade changes and slope to drains.

B. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Connect to utilities.

C. Set outlets and box covers at finish grade elevations.

D. Provide for thermal movement of components in system.

E. Slope piping for self drainage to gravel filled well point.

F. Use threaded nipples for risers to each outlet.

G. Mark valves with neoprene valve markers containing locking device. Set valve markers in pipe risers extending from top of valve to finish grade.

H. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.

B. Prior to backfilling, test system for leakage at main piping to maintain 100 psi (690 kPa) pressure for one hour.

C. System is acceptable if no leakage or loss of pressure occurs and system self drains during test period.

3.06 BACKFILLING

A. Provide 3 inch (75 mm) sand cover over piping.

B. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.07 SYSTEM STARTUP

A. Prepare and start system in accordance with manufacturer's instructions.

B. Adjust control system to achieve time cycles required.

C. Adjust head types for full water coverage as directed.

3.08 CLOSEOUT ACTIVITIES

A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.

B. Provide a laminated map of the sprinkler system with colored valves. This is to be provided at system training.

3.09 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide one complete spring start-up and a fall shutdown by installer, at no extra cost to Owner.

END OF SECTION

SECTION 32 92 23
SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

1.03 REFERENCE STANDARDS

A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding 2006.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Certificate: Certify grass species and location of sod source.

C. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.

D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer .

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sod: TPI (SPEC), Certified Turfgrass Sod quality; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft (100 sq m). Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

1. Kentucky Blue Grass Type or Local Standard.

B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0. Minimum organic material of 2 percent.

C. Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00.

B. Place topsoil in accordance with Section 31 22 00.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.04 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod immediately after delivery to site to prevent deterioration.

C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.

D. Water sodded areas immediately after installation. Saturate sod to 4 inches (100 mm) of soil.

E. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.05 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

C. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

D. Provide a minimum of three complete mowings, if additional mowings are needed prior to building turn over, these shall be included.

E. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of grass blade at any one mowing.

F. Neatly trim edges.

G. Immediately remove clippings after mowing and trimming.

H. Water to prevent grass and soil from drying out.

I. Roll surface to remove irregularities.

J. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

K. Immediately replace sod to areas that show deterioration or bare spots.

L. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 93 00
PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Topsoil bedding.

C. New trees, plants, and ground cover.

D. Mulch and Fertilizer.

E. Maintenance.

F. Tree Pruning.

1.02 REFERENCE STANDARDS

A. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning) 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.

C. Certificate: Submit certificate for plants free of disease or hazardous insects; as described in ASTM Z60.1; free of disease or hazardous insects.

D. Maintenance Data: Include cutting and trimming method ; types, application frequency, and recommended coverage of fertilizer .

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing and planting the plants approved by nursery.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.06 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C).

B. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide one year warranty.

C. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Plant Materials: Described by ASTM Z60.1; free of disease or hazardous insects.

2.02 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.03 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0. Minimum organic material of 2 percent.

2.04 SOIL AMENDMENT MATERIALS

A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.

B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.05 MULCH MATERIALS

A. Mulching Material: Wood ground bark, free of growth or germination inhibiting ingredients.

2.06 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Membrane: 20 mil (0.5 mm) thick, clear polyethylene.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil are ready to receive work.

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches (75 mm) where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Dig pits and beds 6 inches (150 mm) larger than plant root system.

3.03 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches (100 mm) over area to be planted or to depth as indicated on drawings. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches (150 mm).

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.05 PLANTING

A. Place plants for best appearance for review and final orientation by Architect.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches (of 150 mm) under each plant. Remove burlap, ropes, and wires, from the root ball.

E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch (150 mm) layers. Maintain plant life in vertical position.

F. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.06 INSTALLATION OF ACCESSORIES

A. Place decorative cover and membrane, where indicated on drawings.

3.07 TREE PRUNING

A. Prune trees as recommended in ANSI A300 Part 1.

B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.08 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

C. Maintain plant life immediately after placement and until plants are well established and exhibit a vigorous growing condition. Continue maintenance until termination of warranty period.

D. Irrigate sufficiently to saturate root system and prevent soil from drying out.

E. Cultivate and weed plant beds and tree pits.

F. Remove dead or broken branches and treat pruned areas or other wounds.

G. Neatly trim plants where necessary.

H. Immediately remove clippings after trimming.

I. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

J. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.

K. Remedy damage from use of herbicides and pesticides.

L. Replace mulch when deteriorated.

M. Maintain wrappings, guys, turnbuckles, and stakes. Repair or replace accessories when required.

END OF SECTION

DIVISION 33 - UTILITIES

33 05 00	COMMON UTILITY
33 11 00	WATER UTILITY PIPING
33 31 00	SANITARY SEWER
33 41 00	STORM UTILITY DRAINAGE PIPING

SECTION 33 05 00
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed 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.

C. PVC: Polyvinyl chloride plastic.

D. DI: Ductile Iron pipe

1.4 SUBMITTALS

A. Product Data: For the following:
1. Dielectric fittings.
2. Identification devices.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. 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.

E. Solvent Cements for Joining Plastic Piping:
   1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

F. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:
   1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
   2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:
   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. Cascade Waterworks Mfg. Co.
      b. Dresser, Inc.; DMD Div.
      c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
      d. JCM Industries.
      e. Smith-Blair, Inc.
      f. Viking Johnson.
   3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:
   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. Spears Manufacturing Co.
   3. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

E. Plastic-to-Metal Transition Unions:

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. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Co.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
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. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities.

G. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: 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. 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. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Hart Industries, International, Inc.
    e. Watts Water Technologies, Inc.
    f. Zurn Plumbing Products Group; Wilkins Div.
3. Description: Factory fabricated, union, NPS 2 and smaller.
    a. Pressure Rating: 150 psig minimum.

C. Dielectric Flanges:
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. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Water Technologies, Inc.
3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
    a. Pressure Rating: 175 psig minimum.

D. Dielectric-Flange Kits:

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. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.
3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
    a. Pressure Rating: 150 psig minimum.
    b. Gasket: Neoprene or phenolic.
    c. Bolt Sleeves: Phenolic or polyethylene.
    d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
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. Calpico, Inc.
    b. Lochinvar Corporation.
3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
    a. Pressure Rating: 300 psig at 225 deg F
    b. End Connections: Threaded.

F. Dielectric Nipples:
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. Perfection Corporation.
    b. Precision Plumbing Products, Inc.
    c. Victaulic Company.
3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
    a. Pressure Rating: 300 psig at 225 deg F.
    b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
   2. Location: Accessible and visible.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
   1. Cement: ASTM C 150, Type I, portland.
   2. Density: 115- to 145-lb/cu. ft.
   3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
   4. Aggregates: ASTM C 33, natural sand, fine.
   5. Admixture: ASTM C 618, fly-ash mineral.
   6. Water: Comply with ASTM C 94/C 94M.
   7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility 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. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
   5. 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.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
   1. NPS 2 and Smaller: Dielectric unions.
   2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
   1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples or nipples.
   2. NPS 2-1/2 to NPS 4 : Dielectric nipples.
   3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
   4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 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 the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
      a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 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. 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.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. 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 (0.20 percent maximum lead content) complying with ASTM B 32.

I. 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.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic 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. 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.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic 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 PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 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. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping. Place direct bury marker 12-18 inches above top of pipe but not less than 12-inches below finish grade.

3.9 GROUTING

A. Mix and install grout for 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

SECTION 33 11 00
WATER UTILITY PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Codes and Standards:
1. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of potable water system materials and products.
2. Water Purveyor Compliance: Comply with requirements of Purveyor supplying water to project, obtain required permits and inspections.
3. NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for Installation of Private Fire Service Mains and Their Appurtenances".
4. Local Fire Department/Marshall Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.
5. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service" and are listed by UL.

1.2 SUMMARY

A. This Section includes pressure water pipes and fire systems outside the building, with the following components:
1. Special fittings for expansion and deflection.
2. Pipes and valves.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. DI: Ductile Iron pressure pipe.

1.4 PERFORMANCE REQUIREMENTS

A. Pressure Rating: 175 psi static water pressure for all pipes and fittings. Pipe joints shall be water tight.

1.5 SUBMITTALS

A. Product Data: For the following:
1. Special pipe fittings.
2. Valves.
3. Valve boxes and appurtenances.
4. Pipes.
5. Disinfection reports and practices
6. Product Data: Submit manufacturer's technical product data and installation instructions for fire water system materials and products.
7. Maintenance Data: Submit maintenance data and parts lists for fire water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

B. Shop Drawings: For the following:
1. Thrust Blocks: Include plans, elevations, sections, details, and forces for thrust blocks for each size of pipe and type of bend.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping and sewer system piping. Indicate interface and spatial relationship between 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 and vertical scale of not less than 1 inch equals 5 feet. Indicate

manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.7 PROJECT CONDITIONS

A. Interruption of Water Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service. Coordinate interruptions during weekly meetings and at pre-construction meeting.
   2. Do not proceed with interruption of service without Architect's, Construction Manager's, and Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work.
   2. Line Markers:
      a. Allen Systems Inc.
      b. Seton Name Plate Corp.
      c. Engineer Approved Equal.
   3. Pipe Strainers:
      a. "Automatic" Sprinkler Corp. of America; Div. A-T-O Inc.
      b. Cleveland Gear Co.; Sub of Vesper Corp.
      c. Grinnell Fire Protection Systems Co., Inc.
      d. Hersey Products Inc.; Hersey Div.
      e. Mueller Steam Specialty; Div. of Core Industries Inc.
      f. Neptune Water Meter Co.
      g. Rockwell International Corp.; Municipal & Utility Div.
      h. Rockwood Systems Corp.
      i. Zurn Industries Inc.; Fluid Handling Div.
   4. Detector Meter: Not Required
   5. Gate Valves:
      a. American Valve Mfg. Corp.
      b. American-Darling Valve; Div. of American Cast Iron Pipe Co.
      c. Clow Corp.; Valve Div.
      d. Dresser Mfg. Div. of ITT Grinnell Valve Co. Inc.
      e. Fairbanks Co.
      f. Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.
      g. Stockham Valves & Fittings Inc.
      h. United Brass Works Inc.
      i. United States Pipe and Foundry Co.
      j. Waterous Co.
   6. Check Valves:
      a. American-Darling Valve; Div. of American Cast Iron Pipe Co.
      b. Clow Corp.; Valve Corp.
      c. Fairbanks Co.
      d. Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.

e. Mueller Co.
f. Nibbco Inc.
g. Stockham Valves & Fittings Inc.
h. Walworth Co.
i. Waterous Co.

7. Yard Hydrants
   a. Josam Mfg. Co.
   b. Smith (Jay R.) Mfg. Co.
   c. Zern Industries, Inc.; Hydromechanics Div.
8. Fire Hydrants: Approved by authority having jurisdiction.
9. Backflow Preventors: Approved by authority having jurisdiction.

2.2 IDENTIFICATION

A. Underground –Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".

B. Nonmetallic Piping Label: If nonmetallic piping is used for water service, provide engraved plastic laminate, label permanently affixed to main electrical meter panel stating "THIS STRUCTURE HAS A NONMETALLIC WATER SERVICE".

2.3 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems. Where more than one type of materials or products are indicated, selection is Installer's option.

C. Piping: Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

D. PVC Pipe: AWWA C900 DR-18 Pipe for gasketed joints and using ASTM F 477, elastomeric seals.
   1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
   2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

E. Ductile Iron Pipe: Polyethylene wrapped Ductile Iron Class 50, with cement mortar lining complying with AWWA C104 (for 6” pipe and larger).
   1. Fitting: Ductile iron AWWA C151; cement lined AWWA C104; and rubber-gasket joints, AWWA C111.

F. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 200 psig.
   1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

2.4 WATER METER

A. Contractor to purchase and install all water meters, meter sets and lids.

B. Contractor to supply concrete meter box and accessories needed to make installation of water meter.

2.5 VALVES

A. Gate Valves: UL-listed, 175 psi working pressure for 12" and smaller, 150 psi for sizes larger than 12". Threaded, flanged, hub, or other end configurations to suit size of valve and piping

connection. Inside screw type for use with indicator post, iron body bronze mounted, non- rising stem, solid wedge disc.

B. Check Valves: UL-listed, 175 psi working pressure for 2" through 12", 150 psi for sizes larger than 12". Swing type, iron body bronze mounted with metal-to-metal or rubber-faced checks. Threaded, flanged, or hub end, to suit size and piping connections.

2.6 FIRE HYDRANT

A. Provide cast-iron body fire hydrants, compression type, opening against pressure and closing with pressure, base valve design, 200 psi working pressure, with 1/4" gage tapping and bronze plug in standpipe, conforming to the latest edition of AWWA C-502, "Dry Barrel Fire Hydrants."

B. Features: Provide the following features:
1. Size: 5" valve opening.
2. Direction to Open Hydrant: Left.
3. Size and Shape of Operating and Cap Nuts: Pentagon 1-1/2" point to flat.
4. Hose Nozzles: 2-1/2" National Standard Thread cap and chain.
5. Pumper Nozzles: 5" National Standard Thread cap and chain.
6. Depth of Trench: 4'-6".
7. Connection to Main: 6" mechanical joint.

2.7 ACCESSORIES

A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

B. Clamps, Straps, and Washers: Steel, ASTM A 506.

C. Rods: Steel, ASTM A 575.

D. Rod Couplings: Malleable-iron, ASTM A 197.

E. Bolts: Steel, ASTM A 307.

F. Cast-Iron Washers: Gray-iron, ASTM A 126.

G. Thrust Blocks: Concrete, 3,000 psi.

2.8 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. Thrust Blocks, Hydrant Supports, and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

PART 3 - EXECUTION

3.1 **Examination: Examine areas and conditions under which potable water system's materials and** products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 EARTHWORK

A. Excavation trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 INSTALLATION

A. Identification: During back-filling/top-soiling of underground fire water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. If pvc pipe is used, install a tracer wire along the top of the pipe, secured with tape, and extending to fire hydrants and valves.

B. Pipe and pipe fittings:

1. Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances".
2. Depth of Cover: Provide minimum depth of cover over underground piping in accordance with NFPA 24, Figure A-8-11 "Recommended Depth of Cover Above Top of Underground Yard Mains" or 60" below finish grade, whichever is greater.

C. Piping Specialties:
1. Pipe Line Strainers: Install as indicated, with valved blowoff piped to drain.

D. Meters: Install as indicated with shutoff valve on either side of meter and valved bypass full line size.

E. Valves: Provide post indicator for control valves.
1. Shutoff Valves: Install shutoff valve ahead of each hydrant.

3.4 PIPING APPLICATIONS

A. Pipe:
1. Ductile Iron Pipe: Install in accordance with AWWA C600 "standard for installation of ductile-iron water mains and their appurtenances" and in accordance with instructions from water purveyor.
2. PVC Pressure pipe, PVC pressure fittings, gaskets, and gasketed joints.
3. PE Pipe: Install in according to ASTM D 2774 and ASTM F 645.

B. Depth of Cover: Provide minimum cover over piping of 12" below average local frost depth or 42" below finished grade, whichever is greater.

C. Water Main Connection: Arrange and pay for tap in water main, of size and in location as indicated, from water Purveyor.

D. Water Service Termination: Terminate potable water piping 5'-0" from building foundation in location and invert as indicated. Provide temporary pipe plug for piping extension into building.
1. Mark location with surface marker.

3.5 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground water pipes. 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 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.

C. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

D. Install piping according to 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 line and grade as indicated or below frost line if not inidcated.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23 or ASTM D 2774 and ASTM F 1668.
6. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

3.6 INSTALLATION OF VALVES

A. Install valves with stems pointing up. Provide valve box over underground valves.

3.7 INSTALLATION OF WATER METER AND VAULT

A. Install Water Meter and Vault to comply with City Water Department Standards.

3.8 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join pressure piping according to the following:
   1. Join ductile-iron pressure piping according to AWWA C660 or AWWA M41 for push-on joints.
   2. Join ductile-iron special fittings according to AWWA C660 or AWWA M41 for push-on joints.
   3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
   4. Join PVC water-service piping according to ASTM D 2855 for solvent-cemented joints.

C. Join dissimilar pipe materials with pressure-type couplings.

3.9 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline with water 24-hrs prior to testing, and apply test pressure to stabilize system.

B. Hydrostatic Tests: Test at not less than 200 psi for 2-hrs, or at 50 psi above maximum static pressure if it is greater than 150 psi.
   1. Test fails if leakage exceeds 2-qts per hour per 100 gaskets or joints irrespective of pipe diameter.
   2. Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.

C. Operating Tests: Open and close all valves and hydrants under system water pressure. Check dry barrel hydrants for proper drainage.
   1. For systems with fire pumps, run pumps during operating tests.

3.10 ADJUSTING AND CLEANING

A. Disinfection of Potable Water System: Flush pipe system with clean potable water until no dirty water appears at point of outlet. Fill system with water-chlorine solution containing at least 50 ppm of chlorine. Valve off system and let stand for 24- hrs minimum. Flush with clean potable water until no chlorine remains in water coming from system.
   1. Repeat procedure if contamination is present in bacteriological examination.

B. Disinfection of Water Mains: Flush and disinfect in accordance with AWWA C651 "Standard for Disinfecting Water Mains".
   1. Contractor shall submit written verification to Project Manager stating, Disinfection has been completed in strict compliance with specification for this project and with jurisdiction having authority over water system.

3.11 ADJUSTING AND CLEANING

A. Flushing: Flush underground mains and lead-in connections to sprinkler risers before connection is made to sprinklers, standpipes, or other fire protection system piping.
   1. Flush at flow rate not less than that indicated in NFPA 24, or at hydraulically calculated water demand rate of the system, whichever is greater.

B. Adjusting: adjust fire hydrants to face street and be have base 2-6 inches above adjacent curb and gutter.

3.12 CLOSING ABANDONED WATER 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-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. Backfill to grade according to Division 31 Section "Earth Moving."

END OF SECTION

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SECTION 33 31 00
SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
   1. Special fittings for expansion and deflection.
   2. Cleanouts.
   3. Drains.
   4. Sewerage Pipes.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Sewer-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least water tight under specified head, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Special pipe fittings.
   2. Cleanout materials.
   3. Pipes.

B. 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.

C. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 60 feet and vertical scale of not less than 1 inch equals 8 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

D. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 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 according to requirements indicated:
   1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of service. Coordinate interruptions during weekly meetings and at pre-construction meeting.
   2. Do not proceed with interruption of service without Architect's, Construction Manager's, and Owner's written permission.
   3. If shutdown will affect city streets, other city utilities, or city sewer line, do not proceed without approval from city.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include local pre-cast manufacturers but are subject to approval of the engineer and architect.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 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.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T 2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Use non-pressure type couplings only when pipes can not be connected together with standard fittings and typical pipe connections such as bell and spigot. If possible, file the end on existing pipes to create spigot type connections to match existing pipe ends for connection to a new bell for an extension of the pipe.

B. 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.

C. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

D. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Dallas Specialty & Mfg. Co.
      b. Fernco Inc.
      c. Logan Clay Products Company (The).
      d. Mission Rubber Company; a division of MCP Industries, Inc.
      e. NDS Inc.
      f. Plastic Oddities, Inc.

E. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Cascade Waterworks Mfg.
      b. Dallas Specialty & Mfg. Co.

c. Mission Rubber Company; a division of MCP Industries, Inc.

F. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
1. Manufacturers:
a. Fernco Inc.
b. Logan Clay Products Company (The).
c. Mission Rubber Company; a division of MCP Industries, Inc.

G. Split-Sleeve Couplings: With split sleeve with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
1. Manufacturers:
a. Brico Industries.
2. Sleeve Material: Manufacturer's standard.
3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
5. Metal Component Finish: Corrosion-resistant coating or material.

2.6 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. Manufacturers:
a. Josam Company.
b. MIFAB Manufacturing, Inc.
c. Smith, Jay R. Mfg. Co.
d. Wade Div.; Tyler Pipe.
e. Watts Industries, Inc.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
2. Top-Loading Classification(s): Light, Medium, Heavy, and Extra-heavy duty depending on location and expected driving load on cleanout.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Place in grey iron housing with clamping device and round, secured, scoriated, gray-iron cover.
1. Manufacturers:
a. Canplas Inc.
b. Josam Company
c. MIFAB Manufacturing, Inc.
d. Wad Div.; Tyler Pipe
e. Watts Industries, Inc.
f. Zern Industries, Inc; Zern Specification Drainage Operation
g. IPS Corporation.
h. NDS Inc.
i. Plastic Oddities, Inc.
j. Sioux Chief Manufacturing Company, Inc.
k. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.7 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. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 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.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe 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. Flexible or rigid couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible or rigid 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 any of the following pipe materials for each size range:
   1. PVC sewer pipe and fittings; gaskets; and gasketed joints.
   2. Ductile-iron pressure pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
   3. PVC pressure, PVC pressure fittings, gaskets, and gasketed joints.

3.3 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.

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 use of lubricants, cements, and other installation requirements.

C. 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.

D. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

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 restrained joints at tee fittings and at changes in direction for pressure pipe. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   3. Install piping with cover indicated.
   4. Notify engineer of clearance problems that would result in changes to grade and alignment.
   5. Install ductile-iron culvert piping according to ASTM A 716.
   6. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
   7. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
   8. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." 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 ductile-iron culvert piping according to AWWA C600 for push-on joints.
   2. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
   3. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cement joints.
   4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
   5. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
   6. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use same pipe type as sewer line that the cleanout is connected to. 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 areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 inches around outside of cover. At contractors option, a square block can be used that is at least 12-inches wider that the cover. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary sewer system.

B. Connect force-main pressure piping to building's force mains where indicated. **(Not Used)**

3.8 CLOSING ABANDONED SEWER 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-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 below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.9 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." 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.

3.10 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 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. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
      f. Test for infiltration or exfiltration between manholes as follows:
         1) Clean section of sewer line of dirt. Debris, gravel, rocks and other items.
         2) Fill section between manholes with water. Allow water to sit in pipe for not less than 3-hours to acclimate to surrounding earth temperature.
         3) Use a water pump to pressurize the sewer pipe section to not less than 5 psi and not more than 10 psi. Record starting pressure.
         4) Turn off water pressure and wait 20 minutes.
         5) Refill pipe to same pressure as in step 3 and measure volume required to fill pipe to same pressure.
         6) Pipe section passes test if volume required to refill pipe is less than ½-gallon per 400 feet of 8-inch pipe. Prorate the allowable seepage larger or smaller pipes and for shorter or longer distances.
         7) Find and fix leaks in any section that fails to pass test. Fix any visible leaks found even if section of pipe passes test.
   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 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.

3.11 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION

SECTION 33 41 00
STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Special fittings for expansion and deflection.
   2. Cleanouts.
   3. Drains, Trench Drains, Slot Drains, Land Drains
   4. Precast concrete manholes, inlet boxes, catch basins.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. CP: Non-reinforced concrete pipe.

C. RCP: Reinforced concrete pipe.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Special pipe fittings.
   2. Drains.
   3. Storage.
   4. Pipes.

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.
   2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
   3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

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 and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 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 according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 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 according to requirements indicated:
   1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service. Coordinate interruptions during weekly meetings and at pre-construction meeting.
   2. Do not proceed with interruption of service without Architect's, Construction Manager's, and Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include local pre-cast manufacturers but are subject to approval of the engineer and architect.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 PVC PIPE AND FITTINGS

A. PVC Pressure Pipe: AWWA C900, Class 150 for gasketed joints and using ASTM F 477, elastomeric seals.
   1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
   2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.

C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.

D. 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.

E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T 2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.5 CONCRETE PIPE AND FITTINGS

A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14, Class I, II or III, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.

B. Piping in paragraph below is available in 5 classes and 3 wall thicknesses, and in NPS 12 to NPS 144. Not all classes and wall thicknesses are available. Joints are gasket type. Contractor, at his option, may use non-reinforced pipe for sizes up to 21-inches if structural requirements based on load on pipe are not exceeded for that pipe. If reinforced pipe is selected, choose the pipe class and wall thickness to suit availability and structural requirements based on loads and cover.

C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets.
   1. Class III

2.6 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 Concrete Pipes: ASTM C 443, rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. 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.
   1. Manufacturers:
      a. Dallas Specialty & Mfg. Co.
      b. Fernco Inc.
      c. Logan Clay Products Company (The).
      d. Mission Rubber Company; a division of MCP Industries, Inc.
      e. NDS Inc.
      f. Plastic Oddities, Inc.

D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   1. Manufacturers:
      a. Cascade Waterworks Mfg.
      b. Dallas Specialty & Mfg. Co.
      c. Mission Rubber Company; a division of MCP Industries, Inc.

E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
   1. Manufacturers:
      a. Fernco Inc.
      b. Logan Clay Products Company (The).
      c. Mission Rubber Company; a division of MCP Industries, Inc.

2.7 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. Manufacturers:
      a. Josam Company.
      b. MIFAB Manufacturing, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Wade Div.; Tyler Pipe.
      e. Watts Industries, Inc.
      f. Watts Industries, Inc.; Enpoco, Inc. Div.
      g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
   2. Top-Loading Classification(s): Light, Medium, Heavy, and Extra-heavy duty depending on location and expected driving load on cleanout.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Place in grey iron housing with clamping device and round, secured, scoriated, gray-iron cover.
   1. Manufacturers:
      a. Canplas Inc.
      b. IPS Corporation.
      c. NDS Inc.
      d. Plastic Oddities, Inc.
      e. Sioux Chief Manufacturing Company, Inc.
      f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.8 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
   1. Manufacturers:
      a. Josam Company.
      b. MIFAB Manufacturing, Inc.
      c. Smith, Jay R. Mfg. Co.
      d. Wade Div.; Tyler Pipe.
      e. Watts Industries, Inc.
      f. Watts Industries, Inc.; Enpoco, Inc. Div.
      g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
   2. Top-Loading Classification(s): Medium and heavy duty depending on location and expected driving load.

2.9 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 and as needed for pipe sizes.
   2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   3. Base Section: 9-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 lengths 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: Not used.
   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 "STORM SEWER."
      a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing manhole frames and covers.
      b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.

B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO 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. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   3. Steps: Not used.
   4. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
   5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
   6. 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 "STORM SEWER."
      a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated and to match existing frames and covers.
      b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint 15-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.10 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. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 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.

2.11 CATCH BASINS

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. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
   3. Top Section: Flat-slab-top type with hole for frame and grate is indicated.
   4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   5. 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.
   6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match frame and grate.
   7. Steps: Not Used.
   8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section. Size sections and box or manhole to fit pipes without necesary

B. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Bottom, Walls, and Top: Reinforced concrete.

2. Channels and Benches: Concrete.
3. Steps: Not used.

C. Frames and Grates: ASTM A 536, 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 minimum, unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with small, square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.12 STORMWATER INLETS

A. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates. All grates to be bicycle safe.

B. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

2.13 DRY WELLS

A. Description: ASTM C 913, precast, reinforced, perforated concrete manholes with ring and cover, frame and grate, or lid as indicated and include the following:
1. Floor: Cast-in-place concrete support ring.
2. Cover: Liftoff-type concrete cover with cast-in lift rings.
3. Wall Thickness: 4 inches minimum with 1-inch diameter or 1-by-3-inch 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 D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.

2.14 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

A. Description, General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total lengths indicated.

B. Manufacturers:
1. ABT, Inc.
2. ACO Polymer Products, Inc.
3. Innovative Plastics Products. Inc.
4. Mea-Josam Div.; Josam Company.
5. Strongwell; Lenoir City Div.

C. Sloped-Invert, Polymer-Concrete Systems: Include the following components:
1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include inside width and depth as indicated with rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
2. Frame: Include gray-iron for grate.
3. Grates with manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
a. Material: Metal
4. Covers: Solid gray iron, if indicated.
5. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Narrow-Width, Level-Invert, Polymer-Concrete Systems: Include the following components:
1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 5-inch inside width and 9-3/4-inch deep, rounded bottom, with level invert and with NPS 4 outlets in number and locations indicated.

2. Grates with slots or perforations that fit recesses in channels.
   a. Material: Gray iron.
3. Covers: Solid gray iron, if indicated.
4. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe 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. Flexible or rigid couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible or rigid 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.

B. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
   1. PVC water-service pipe; PVC Schedule 40, water-service-pipe fittings; and solvent-cemented joints.
   2. PVC sewer pipe and fittings; gaskets; and gasketed joints.
   3. Class 2, nonreinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
   4. Ductile-iron culvert pipe, ductile-iron standard or compact fittings, gaskets, and gasketed joints.
   5. Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
   6. Corrugated steel pipe and fittings, standard and special-joint bands, and banded joints.
   7. Corrugated aluminum pipe and fittings, standard and special-joint bands, and banded joints.
   8. Corrugated PE pipe and fittings, silttight couplings, and coupled joints.

3.3 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 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. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. 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 restrained joints at tee fittings and at changes in direction for pressure pipe. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with cover indicated.
4. Notify engineer of clearance problems that would result in changes to grade and alignment.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron culvert piping according to ASTM A 716.
7. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
8. Install corrugated steel piping according to ASTM A 798/A 798M.
9. Install corrugated aluminum piping according to ASTM B 788/B 788M.
10. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
12. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
13. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
14. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." 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 ductile-iron culvert piping according to AWWA C600 for push-on joints.
2. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
3. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
4. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
5. Join corrugated PE piping according to CPPA 100 and the following:
   a. Use silttight couplings for Type 1, silttight joints.
6. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cement joints.
7. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
8. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
9. Join nonreinforced-concrete sewer piping according to ASTM C 14and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
10. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
11. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use same pipe type as sewer line that the cleanout is connected to. 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 areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 inches around outside of cover. At contractors option, a square block can be used that is at least 12-inches wider that the cover. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 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 areas.

B. Embed drains in 4-inch minimum depth of 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 minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

C. Align boxes so that frame and grates are square to adjacent sidewalks, curbs or roadways.

3.9 STORMWATER INLET AND OUTLET 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 24 inches greater than outside of dry well. Do not extend excavation into ground-water table.
   1. Install filter fabric as indicated. Provide sufficient filter fabric to lap sliced areas at least 12-inches.

B. Install precast, concrete-ring dry wells according to the following:
   1. Assemble rings to depth indicated.
   2. Extend rings to height where top of cover will be approximately 8 inches below finished grade.
   3. Backfill bottom of inside of rings with filtering material to level at least as indicated on plans.
   4. Extend effluent inlet pipe 12 inches into rings and terminate into side of tee fitting.
   5. Backfill around outside of rings with filtering material to top level of rings and to depth indicated.
   6. Install cover over top of rings.

3.11 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.12 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.

E. Fasten grates to channel sections if indicated.

F. Assemble channel sections with flanged or interlocking joints.

G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.13 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Connect force-main pressure piping to building's storm drainage force mains specified in Division 22 Section "Facility Storm Drainage Piping." Terminate piping where indicated.
   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.
   2. 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.

C. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.14 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-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 below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section "Earth Moving."

3.15 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." 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.

3.16 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 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. 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 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 according to 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 according to ASTM F 1417.
      c. Option: Test concrete 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.

3.17 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

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